- Table 3.3.2-5 Emergency Equipment Cooling Water System—Summary of Aging Management Evaluation
- Table 3.3.2-6 Compressed Air Systems—Summary of Aging Management Evaluation
- Table 3.3.2-7 Fire Protection – Water System—Summary of Aging Management Evaluation
- Table 3.3.2-8 Fire Protection – CO_2 and Halon System—Summary of Aging Management Evaluation
- Table 3.3.2-9 Combustion Turbine Generator System—Summary of Aging Management Evaluation
- Table 3.3.2-10 Emergency Diesel Generator System—Summary of Aging Management Evaluation
- Table 3.3.2-11 Heating, Ventilation and Air Conditioning Systems—Summary of Aging Management Evaluation
- Table 3.3.2-12 Control Center Heating, Ventilation and Air Conditioning System—Summary of Aging Management Evaluation
- Table 3.3.2-13 Containment Atmospheric Control Systems—Summary of Aging Management Evaluation
- Table 3.3.2-14 Plant Drains—Summary of Aging Management Evaluation
- Table 3.3.2-15 Fuel Oil Systems—Summary of Aging Management Evaluation
- Table 3.3.2-16 Primary Containment Monitoring and Leakage Detection Systems—Summary of Aging Management Evaluation

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

- Table 3.3.2-17-1 CRD Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-2 Standby Liquid Control System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-3 Process Radiation Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.3.2-17-4 Radioactive Waste System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-5 Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-6 Fuel Pool Cooling and Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-7 Torus Water Management System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-8 Local Panels and Racks 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—Summary of Aging Management Evaluation
- Table 3.3.2-17-10 Potable Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-11 Process Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-12 Post-Accident Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-13 General Service Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-14 Reactor Building Closed Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-15 Turbine Building Closed Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.3.2-17-16 Emergency Equipment Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-17 Emergency Equipment Service Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-18 Supplemental Cooling Chilled Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-19 Station Air, Control Air, Emergency Breathing Air System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-20 Auxiliary Boiler 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—Summary of Aging Management Evaluation
- Table 3.3.2-17-22 On-Line Noble Chemistry Injection System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-23 Fire Protection System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-24 Zinc Injection System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-25 Emergency Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-26 Reactor/Auxiliary Building Systems, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-27 Storage Pools System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.3.2-17-28 Reactor/Auxiliary Building HVAC System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-29 Floor and Equipment Drains System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-30 Containment Atmospheric Control System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-31 Primary Containment Pneumatics System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-32 Primary Containment Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-33 Turbine Building HVAC System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-34 Turbine Building Potable Water and Plumbing System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-17-35 RHR Complex and Office Service Building HVAC Systems, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- 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

3.3.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the auxiliary systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.3.2.1.1 Control Rod Drive System

Materials

Control rod drive system components are constructed of the following materials.

- Carbon steel
- Stainless steel

Environments

Control rod drive system components are exposed to the following environments.

- Air – indoor
- Gas
- Treated water
- Treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the control rod drive system require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the control rod drive system components.

- Bolting Integrity
- External Surfaces Monitoring
- One-Time Inspection
- Water Chemistry Control – BWR

3.3.2.1.2 Standby Liquid Control System

Materials

Standby liquid control system components are constructed of the following materials.

- Carbon steel
- Stainless steel

Environments

Standby liquid control system components are exposed to the following environments.

- Air – indoor
- Concrete
- Sodium pentaborate solution

Aging Effects Requiring Management

The following aging effects associated with the standby liquid control system require management.

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for standby liquid control system components.

- Bolting Integrity
- One-Time Inspection
- Water Chemistry Control – BWR

3.3.2.1.3 Service Water Systems

Materials

Service water system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Elastomer
- Stainless steel

Environments

Service water system are exposed to the following environments.

- Air – outdoor
- Concrete
- Condensation
- Gas
- Lube oil
- Raw water
- Soil

Aging Effects Requiring Management

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

- Change in material properties
- Cracking
- Loss of material
- Loss of material – wear
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the service water system components.

- Bolting Integrity
- Buried and Underground Piping
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Service Water Integrity

3.3.2.1.4 Fuel Pool Cooling and Cleanup System

Materials

Fuel pool cooling and cleanup system components are constructed of the following materials.

- Aluminum
- Aluminum/boron carbide
- Boron carbide / elastomer
- Carbon steel
- Stainless steel

Environments

Fuel pool cooling and cleanup system components are exposed to the following environments.

- Air – indoor
- Concrete
- Treated water
- Treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the fuel pool cooling and cleanup system require management.

- Change in material properties
- Cracking
- Loss of material
- Loss of preload
- Reduction in neutron absorption capacity

Aging Management Programs

The following aging management programs manage the aging effects for the fuel pool cooling and cleanup system components.

- Bolting Integrity
- Boraflex Monitoring
- External Surfaces Monitoring
- One-Time Inspection

- Neutron-Absorbing Material Monitoring
- Water Chemistry Control – BWR

3.3.2.1.5 Emergency Equipment Cooling Water System

Materials

Emergency equipment cooling water system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Nickel alloy
- Stainless steel

Environments

Emergency equipment cooling water system components are exposed to the following environments.

- Air – indoor
- Condensation
- Gas
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the emergency equipment cooling water system require management.

- Cracking – fatigue
- Fouling
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the emergency equipment cooling water system components.

- Bolting Integrity
- External Surfaces Monitoring

- Service Water Integrity
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.6 Compressed Air Systems

Materials

Compressed air system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc (inhibited)
- Copper alloy > 15% zinc or > 8% aluminum
- Elastomer
- Nickel alloy
- Stainless steel

Environments

Compressed air system components are exposed to the following environments.

- Air – indoor
- Condensation
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the compressed air systems require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the compressed air system components.

- Bolting Integrity

- Compressed Air Monitoring
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.7 Fire Protection – Water System

Materials

Fire protection – water system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Gray cast iron
- Stainless steel

Environments

Fire protection – water system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Exhaust gas
- Lube oil
- Raw water
- Soil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the fire protection – water system require management.

- Cracking – fatigue
- Fouling
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the fire protection – water system components.

- Bolting Integrity
- Buried and Underground Piping
- External Surfaces Monitoring
- Fire Water System
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.8 Fire Protection – CO_2 and Halon System

Materials

Fire protection – CO_2 and Halon system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Glass
- Stainless steel
- Teflon

Environments

Fire protection – CO_2 and Halon system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Gas

Aging Effects Requiring Management

The following aging effects associated with the fire protection – CO_2 and Halon system require management.

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the fire protection – CO_2 and Halon system components.

- Bolting Integrity
- Fire Protection
- Internal Surfaces in Miscellaneous Piping and Ducting Components

3.3.2.1.9 Combustion Turbine Generator System

Materials

Combustion turbine generator system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc (inhibited)
- Copper alloy > 15% zinc or > 8% aluminum
- Elastomer
- Glass
- Stainless steel

Environments

Combustion turbine generator system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Exhaust gas
- Fuel oil
- Lube oil
- Soil

- Treated water
- Treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the combustion turbine generator system require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of material – wear
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the combustion turbine generator system components.

- Bolting Integrity
- Buried and Underground Piping
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.10 Emergency Diesel Generator System

Materials

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

- Aluminum
- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc (inhibited)
- Copper alloy > 15% zinc or > 8% aluminum

- Glass
- Stainless steel

Environments

Emergency diesel generator system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Exhaust gas
- Lube oil
- Raw water
- Treated water
- Treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the emergency diesel generator system require management.

- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of material – wear
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the emergency diesel generator system components.

- Bolting Integrity
- Compressed Air Monitoring
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching

- Service Water Integrity
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.11 Heating, Ventilation and Air Conditioning Systems

Materials

Heating, ventilation and air conditioning system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Elastomer
- Stainless steel

Environments

Heating, ventilation and air conditioning system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Concrete
- Condensation
- Gas
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the heating, ventilation and air conditioning systems require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of material – wear
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the heating, ventilation and air conditioning system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.12 Control Center Heating, Ventilation and Air Conditioning System

Materials

Control center heating, ventilation and air conditioning system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Fiberglass
- Glass
- Graphite
- Stainless steel

Environments

Control center heating, ventilation and air conditioning system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Gas
- Lube oil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the control center heating, ventilation and air conditioning system require management.

- Fouling
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the control center heating, ventilation and air conditioning system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Selective Leaching
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.13 <u>Containment Atmospheric Control Systems</u>

Materials

Containment atmospheric control system components are constructed of the following materials.

- Carbon steel
- Stainless steel

Environments

Containment atmospheric control system components are exposed to the following environments.

- Air – indoor
- Gas

Aging Effects Requiring Management

The following aging effects associated with the containment atmospheric control systems require management.

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the containment atmospheric control system components.

- Bolting Integrity
- External Surfaces Monitoring
- Periodic Surveillance and Preventive Maintenance

3.3.2.1.14 <u>Plant Drains</u>

Materials

Plant drains components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Stainless steel

Environments

Plant drains components are exposed to the following environments.

- Air – indoor
- Concrete
- Waste water

Aging Effects Requiring Management

The following aging effects associated with the plant drains require management.

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the plant drains components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components

3.3.2.1.15 Fuel Oil Systems

Materials

Fuel oil system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Stainless steel

Environments

Fuel oil system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Fuel oil
- Soil

Aging Effects Requiring Management

The following aging effects associated with the fuel oil systems require management.

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the fuel oil system components.

- Aboveground Metallic Tanks
- Bolting Integrity
- Buried and Underground Piping

- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection

3.3.2.1.16 Primary Containment Monitoring and Leakage Detection Systems

Materials

Primary containment monitoring and leakage detection system components are constructed of the following materials.

- Carbon steel
- Stainless steel

Environments

Primary containment monitoring and leakage detection system components are exposed to the following environments.

- Air – indoor
- Condensation
- Gas
- Steam
- Treated water
- Treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the primary containment monitoring and leakage detection systems require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the primary containment monitoring and leakage detection system components.

- Bolting Integrity
- External Surfaces Monitoring

- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

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

Environments

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Condensation
- Fuel oil
- Gas
- Lube oil
- Raw water
- Sodium pentaborate solution
- Steam
- Treated water
- Treated water > 140°F
- Waste water

Aging Effects Requiring Management

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of material
- Loss of material – wear
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- Buried and Underground Piping
- Compressed Air Monitoring
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fire Water System
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.3.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the Fermi 2 approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.3.2.2.1 Cumulative Fatigue Damage

Where fatigue is identified as an aging effect requiring management for components designed to ASME Code or Crane Manufacturer's Association of America Specification No. 70 (CMAA-70) requirements, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluations of these TLAAs are addressed in Sections 4.3 and 4.7.

3.3.2.2.2 Cracking due to Stress Corrosion Cracking and Cyclic Loading

This paragraph in NUREG-1800 pertains to PWR non-regenerative heat exchanger components and is therefore not applicable to Fermi 2.

3.3.2.2.3 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. There are no stainless steel auxiliary systems components in the scope of license renewal that are located indoors near unducted air intakes.

3.3.2.2.4 Loss of Material due to Cladding Breach

This paragraph in NUREG-1800 pertains to PWR steel charging pump casings with stainless steel cladding exposed to treated borated water and is therefore not applicable to Fermi 2, which is a BWR and has no components exposed to treated borated water.

3.3.2.2.5 Loss of Material due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, loss of material of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. There are no stainless steel auxiliary systems components in the scope of license renewal that are located indoors near unducted air intakes.

3.3.2.2.6 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of Fermi 2 quality assurance procedures and administrative controls for aging management programs.

3.3.2.2.7 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of Fermi 2 operating experience review programs.

3.3.2.2.8 Loss of Material due to Recurring Internal Corrosion

Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on recurring internal corrosion in the development of the license renewal application.

3.3.2.3 Time-Limited Aging Analysis

The only time-limited aging analysis identified for auxiliary systems components is metal fatigue. This is evaluated in Section 4.3.

3.3.3 Conclusion

The auxiliary system components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on auxiliary system components are identified in Section 3.3.2.1 and in the following tables. A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the auxiliary system components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

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**
3.3.1-1	Steel cranes - structural girders exposed to air – indoor uncontrolled (external)	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54 (Standard Review Plan, Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1))	Yes, TLAA	Fatigue is a TLAA. Steel cranes are evaluated as structural components in Section 3.5. See Section 3.3.2.2.1.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-2	Stainless steel, steel heat exchanger components and tubes, piping, piping components, and piping elements exposed to treated borated water, air - indoor, uncontrolled, treated water	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	Fatigue is a TLAA. See Section 3.3.2.2.1.
3.3.1-3	PWR only				
3.3.1-4	Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated	Consistent with NUREG-1801. Cracking of stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program. See Section 3.3.2.2.3.
3.3.1-5	PWR only				
3.3.1-6	Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated	Consistent with NUREG-1801. Loss of material in stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program. See Section 3.3.2.2.5.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-7	PWR only				
3.3.1-8	PWR only				
3.3.1-9	PWR only				
3.3.1-10	Steel, high-strength closure bolting exposed to air with steam or water leakage.	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, "Bolting Integrity"	No	This item was not used. There is no high-strength steel closure bolting used in auxiliary systems within the scope of license renewal.
3.3.1-11	Steel, high-strength high-pressure pump, closure bolting exposed to air with steam or water leakage	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, "Bolting Integrity"	No	This item was not used. There is no high-strength steel closure bolting used in auxiliary systems within the scope of license renewal.
3.3.1-12	Steel; stainless steel closure bolting, bolting exposed to condensation, air – indoor, uncontrolled (external), air – outdoor (external)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of material for steel and stainless steel bolting is managed by the Bolting Integrity Program.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-13	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	This item was not used. As stated in Item Number 3.3.1-12, loss of material of steel bolting exposed to air in the auxiliary systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment.
3.3.1-14	Steel, stainless steel bolting exposed to soil	Loss of preload	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of preload for steel bolting exposed to soil is managed by the Bolting Integrity Program. There is no stainless steel bolting exposed to soil in the auxiliary systems in scope for license renewal.
3.3.1-15	Steel; stainless steel, copper alloy, nickel alloy, stainless steel closure bolting, bolting exposed to air – indoor, uncontrolled (external), any environment, air – outdoor (external), raw water, treated borated water, fuel oil, treated water	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of preload for steel and stainless steel bolting is managed by the Bolting Integrity Program. There is no copper alloy or nickel alloy bolting in the auxiliary systems in scope for license renewal.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-16	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M25, "BWR Reactor Water Cleanup System"	No	This item was not used. Reactor water cleanup system piping downstream of the second containment isolation valve, 4" NPS or greater that is above 200°F during power operation, is carbon steel and is not subject to NRC Generic Letter 88-01 requirements.
3.3.1-17	Stainless steel heat exchanger tubes exposed to treated water, treated borated water	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. There are no stainless steel heat exchanger tubes exposed to treated water with an intended function of heat transfer in the auxiliary systems in scope for license renewal.
3.3.1-18	Stainless steel high-pressure pump, casing, piping, piping components, and piping elements exposed to treated borated water >60°C (> 140°F), sodium pentaborate solution >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. The operating temperature of the standby liquid control system is below the 140°F threshold for cracking in stainless steel.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-19	Stainless steel regenerative heat exchanger components exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. Regenerative heat exchanger components with an intended function for license renewal are made of carbon steel.
3.3.1-20	Stainless steel, steel with stainless steel cladding heat exchanger components exposed to treated borated water >60°C (> 140°F), treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Cracking of stainless steel components exposed to treated water > 60°C (> 140°F) is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage cracking.
3.3.1-21	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-22	Copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for copper alloy components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.
3.3.1-23	Aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. Loss of material for aluminum components exposed to treated water is addressed in Item 3.3.1-25
3.3.1-24	Aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. Loss of material for aluminum components exposed to treated water is addressed in Item 3.3.1-25.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-25	Stainless steel, steel with stainless steel cladding, aluminum piping, piping components, and piping elements, heat exchanger components exposed to treated water, sodium pentaborate solution	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for stainless steel and aluminum components exposed to treated water or sodium pentaborate is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.
3.3.1-26	Steel (with elastomer lining), steel (with elastomer lining or stainless steel cladding) piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion (only for steel after lining/ cladding degradation)	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. Elastomer linings are not credited for protection of piping in scope for license renewal.
3.3.1-27	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. There are no stainless steel heat exchanger tubes exposed to treated water with an intended function of heat transfer in the auxiliary systems in scope for license renewal.
3.3.1-28	PWR only				

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-29	PWR only				
3.3.1-30	Concrete; cementitious material piping, piping components, and piping elements exposed to raw water	Changes in material properties due to aggressive chemical attack	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal.
3.3.1-30.5	Fiberglass, HDPE [high density polyethylene] piping, piping components, and piping elements exposed to raw water (internal)	Cracking, blistering, change in color due to water absorption	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no fiberglass or HDPE components exposed to raw water in the auxiliary systems in the scope of license renewal.
3.3.1-31	Concrete; cementitious material piping, piping components, and piping elements exposed to raw water	Cracking due to settling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal.
3.3.1-32	Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to raw water	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no reinforced concrete or asbestos cement components exposed to raw water in the auxiliary systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-32.5	Elastomer seals and components exposed to raw water	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no elastomer components exposed to raw water in the auxiliary systems in the scope of license renewal.
3.3.1-33	Concrete; cementitious material piping, piping components, and piping elements exposed to raw water	Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal.
3.3.1-34	Nickel alloy, copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no nickel alloy components exposed to raw water in the auxiliary systems in the scope of license renewal. Copper alloy piping components exposed to raw water are addressed in Item 3.3.1-36.
3.3.1-35	Copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. Copper alloy piping components exposed to raw water are addressed in Item 3.3.1-36.

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 for copper alloy components exposed to raw water is managed by the Service Water Integrity Program.
3.3.1-37	Steel (with coating or lining) 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; lining/ coating degradation	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to raw water is managed by the Service Water Integrity Program. Coatings and linings are not credited for these components.
3.3.1-38	Copper alloy, steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, 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 for copper alloy and steel heat exchanger components exposed to raw water is managed by the Service Water Integrity Program.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-39	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. Stainless steel piping components exposed to raw water are addressed in Items 3.3.1-40 and 3.3.1-41.
3.3.1-40	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to raw water is managed by the Service Water Integrity Program.
3.3.1-41	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to raw water is managed by the Service Water Integrity Program.
3.3.1-42	Copper alloy, titanium, stainless steel heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Fouling of some stainless steel and copper alloy heat exchanger tubes is managed by the Service Water Integrity Program. The Periodic Surveillance and Preventive Maintenance Program manages fouling for copper alloy heat exchanger tubes in the fire protection system. There are no titanium heat exchanger tubes exposed to raw water in the auxiliary systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-43	Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Cracking of stainless steel components exposed to closed-cycle cooling water > 60°C (> 140°F) is managed by the Water Chemistry Control – Closed Treated Water Systems Program.
3.3.1-44	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no stainless steel heat exchanger components exposed to closed-cycle cooling water > 60°C (> 140°F) in the auxiliary systems in the scope of license renewal.
3.3.1-45	Steel piping, piping components, and piping elements; tanks exposed to closed-cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program.
3.3.1-46	Steel, copper alloy heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to general, pitting, and crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material for steel and copper alloy components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-47	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water	Loss of material due to microbiologically influenced corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material for stainless steel heat exchanger components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program.
3.3.1-48	Aluminum piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no aluminum components exposed to closed-cycle cooling water in the auxiliary systems in the scope of license renewal.
3.3.1-49	Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program
3.3.1-50	Stainless steel, copper alloy, steel heat exchanger tubes exposed to closed-cycle cooling water	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Fouling of stainless steel and copper alloy heat exchanger tubes exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. There are no steel heat exchanger tubes exposed to closed-cycle cooling water in the scope of license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-51	Boraflex spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water	Reduction of neutron-absorbing capacity due to boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No	Consistent with NUREG-1801. The change in material properties and reduction of neutron-absorbing capacity of the Boraflex spent fuel storage rack neutron-absorbing sheets exposed to treated water will be managed by the Boraflex Monitoring Program.
3.3.1-52	Steel cranes: rails and structural girders exposed to air – indoor, uncontrolled (external)	Loss of material due to general corrosion	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	Consistent with NUREG-1801. Loss of material for steel crane rails and structural girders exposed to indoor air is managed by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. This item applies to aging management review results presented in Tables 3.5.2-X.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-53	Steel cranes – rails exposed to air – indoor, uncontrolled (external)	Loss of material due to wear	Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	This item was not used. Loss of material due to wear is the result of relative movement between two surfaces in contact with each other. General wear of crane rails may occur during the performance of the active function; as a result of improper design, application, or operation; or to a very small degree with insignificant consequences. Additionally, wear of crane rails due to rolling or sliding wheels is not expected in any measurable amount owing to infrequent crane use. Therefore, loss of material due to wear is not an aging effect requiring management for crane rails exposed to air-indoor, uncontrolled. However, the condition of steel crane rails is monitored by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program under Item 3.3.1-52.
3.3.1-54	Copper alloy piping, piping components, and piping elements exposed to condensation	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No	Consistent with NUREG-1801. Loss of material for copper alloy components exposed to condensation is managed by the Compressed Air Monitoring Program.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-55	Steel piping, piping components, and piping elements: compressed air system exposed to condensation (internal)	Loss of material due to general and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to condensation is managed by the Compressed Air Monitoring Program.
3.3.1-56	Stainless steel piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to condensation is managed by the Compressed Air Monitoring Program.
3.3.1-57	Elastomers fire barrier penetration seals exposed to air - indoor, uncontrolled, air – outdoor	Increased hardness; shrinkage; loss of strength due to weathering	Chapter XI.M26, "Fire Protection"	No	Consistent with NUREG-1801. Increased hardness, shrinkage and loss of strength of elastomer fire barrier seals exposed to indoor air are managed by the Fire Protection Program. This item applies to aging management review results presented in Table 3.5.2-4.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-58	Steel Halon/carbon dioxide fire suppression system piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M26, "Fire Protection"	No	Consistent with NUREG-1801. Loss of material for steel fire protection components exposed to indoor air is managed by the Fire Protection Program.
3.3.1-59	Steel fire rated doors exposed to air - indoor, uncontrolled, air – outdoor	Loss of material due to wear	Chapter XI.M26, "Fire Protection"	No	Consistent with NUREG-1801. Loss of material due to wear of fire doors is monitored by the Fire Protection Program. The Structures Monitoring Program supplements the Fire Protection Program for some doors. This item applies to aging management review results presented in Tables 3.5.2-X.
3.3.1-60	Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air - indoor, uncontrolled	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. Cracking of concrete fire barriers exposed to indoor air is managed by the Fire Protection and Structures Monitoring Programs. This item applies to aging management review results presented in Tables 3.5.2-X

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-61	Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air – outdoor	Cracking, loss of material due to freeze-thaw, aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. Cracking and loss of material of concrete fire barriers exposed to outdoor air are managed by the Fire Protection and Structures Monitoring Programs. This item applies to aging management review results presented in Tables 3.5.2-X.
3.3.1-62	Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air - indoor, uncontrolled, air – outdoor	Loss of material due to corrosion of embedded steel	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. Loss of material of concrete fire barriers exposed to indoor or outdoor air is managed by the Fire Protection and Structures Monitoring Programs. This item applies to aging management review results presented in Tables 3.5.2-X.
3.3.1-63	Steel fire hydrants exposed to air – outdoor	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M27, "Fire Water System"	No	Consistent with NUREG-1801. Loss of material for steel fire hydrants exposed to outdoor air is managed by the Fire Water System Program.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-64	Steel, 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; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Loss of material for steel and copper alloy fire protection system components exposed to raw water is managed by the Fire Water System Program. Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on flow blockage of water-based fire protection system piping in the development of the license renewal application.
3.3.1-65	Aluminum piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	This item was not used. There are no aluminum auxiliary system components exposed to raw water in the scope of license renewal.
3.3.1-66	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Loss of material for stainless steel fire protection system components exposed to raw water is managed by the Fire Water System Program. Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on flow blockage of water-based fire protection system piping in the development of the license renewal application.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-67	Steel tanks exposed to air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Consistent with NUREG-1801. Loss of material for steel tanks exposed to outdoor air is managed by the Aboveground Metallic Tanks Program.
3.3.1-68	Steel piping, piping components, and piping elements exposed to fuel oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. Loss of material for steel components exposed to fuel oil is addressed in Item 3.3.1-70.
3.3.1-69	Copper alloy piping, piping components, and piping elements exposed to fuel oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for copper alloy components exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material.
3.3.1-70	Steel piping, piping components, and piping elements; tanks exposed to fuel oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-71	Stainless steel, aluminum piping, piping components, and piping elements exposed to fuel oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for stainless steel and aluminum components exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material.
3.3.1-72	Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements, heat exchanger components exposed to treated water, closed-cycle cooling water, soil, raw water, waste water	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Consistent with NUREG-1801. Loss of material due to selective leaching for gray cast iron and copper alloy (> 15% Zn or > 8% Al) components is managed by the Selective Leaching Program.
3.3.1-73	Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor	Changes in material properties due to aggressive chemical attack	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-74	Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor	Cracking due to settling	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.
3.3.1-75	Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to air – outdoor	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.
3.3.1-76	Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (internal/external)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Cracking and change in material properties of elastomer components exposed to indoor air are managed by the External Surfaces Monitoring Program.
3.3.1-77	Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor	Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-78	Steel piping and components (external surfaces), ducting and components (external surfaces), ducting; closure bolting exposed to air – indoor, uncontrolled (external), air – indoor, uncontrolled (external), air – outdoor (external), condensation (external)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Loss of material for most steel components exposed to indoor air, outdoor air or condensation is managed by the External Surfaces Monitoring Program. The Fire Protection Program manages loss of material for steel components of the CO_2 and Halon fire suppression systems exposed to outdoor air. The Service Water Integrity Program manages loss of material for steel components of the service water system exposed to outdoor air that are not routinely accessible for inspection under the External Surfaces Monitoring Program.
3.3.1-79	Copper alloy piping, piping components, and piping elements exposed to condensation (external)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Loss of material for copper alloy components exposed to condensation is managed by the External Surfaces Monitoring Program.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-80	Steel heat exchanger components, piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to indoor or outdoor air is managed by the External Surfaces Monitoring Program.
3.3.1-81	Copper alloy, aluminum piping, piping components, and piping elements exposed to air – outdoor (external), air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Loss of material for most copper alloy and aluminum components exposed to outdoor air is managed by the External Surfaces Monitoring Program. The Service Water Integrity Program manages loss of material for copper alloy components of the service water system exposed to outdoor air that are not routinely accessible for inspection under the External Surfaces Monitoring Program.
3.3.1-82	Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (external)	Loss of material due to wear	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Loss of material due to wear of elastomer components exposed to air is managed by the External Surfaces Monitoring Program.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-83	Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Cracking due to stress corrosion cracking	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	This item was not used. The configuration of stainless steel diesel engine exhaust components precludes moisture collection necessary to concentrate contaminates, so these components are not susceptible to cracking.
3.3.1-84	[There is no 3.3.1-84 in NUREG-1800.]				
3.3.1-85	Elastomers elastomer seals and components exposed to closed-cycle cooling water	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. Cracking and change in material properties of elastomer components exposed to closed-cycle cooling water are managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.
3.3.1-86	Elastomers elastomers, linings, elastomer: seals and components exposed to treated borated water, treated water, raw water	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. Cracking and change in material properties of elastomer components exposed to treated water are managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. There are no elastomer components exposed to raw water in the auxiliary systems in the scope of license renewal.
3.3.1-87	[There is no 3.3.1-87 in NUREG-1800.]				

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-88	Steel; stainless steel piping, piping components, and piping elements, piping, piping components, and piping elements, diesel engine exhaust exposed to raw water (potable), diesel exhaust	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. Loss of material for steel and stainless steel components exposed to raw water (potable) or diesel exhaust is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.
3.3.1-89	Steel, copper alloy piping, piping components, and piping elements exposed to moist air or condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	For fire water system components: Chapter XI.M27, "Fire Water System," or for other components: Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material for steel and copper alloy components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.
3.3.1-90	Steel ducting and components (internal surfaces) exposed to condensation (internal)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-91	Steel piping, piping components, and piping elements; tanks exposed to waste water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Loss of material for most steel components exposed to waste water is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The Periodic Surveillance and Preventive Maintenance Program uses periodic visual inspections or other NDE techniques to manage loss of material for other steel components exposed to waste water.
3.3.1-92	Aluminum piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Loss of material for aluminum components potentially exposed to condensation is managed by the Compressed Air Monitoring Program which minimizes the exposure.
3.3.1-93	Copper alloy piping, piping components, and piping elements exposed to raw water (potable)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material for copper alloy components exposed to raw water (potable) is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-94	Stainless steel ducting and components exposed to condensation	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to internal condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.
3.3.1-95	Copper alloy, stainless steel, nickel alloy, steel piping, piping components, and piping elements, heat exchanger components, piping, piping components, and piping elements; tanks exposed to waste water, condensation (internal)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Loss of material for most copper alloy and stainless steel components exposed to waste water or condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The Periodic Surveillance and Preventive Maintenance Program uses periodic visual inspections or other NDE techniques to manage loss of material for other components exposed to waste water. Steel components exposed to condensation are addressed in Item 3.3.1-89.
3.3.1-96	Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (internal)	Loss of material due to wear	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material due to wear of elastomer components exposed to air is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-97	Steel piping, piping components, and piping elements, reactor coolant pump oil collection system: tanks, reactor coolant pump oil collection system: piping, tubing, valve bodies exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. The Fermi 2 containment is inerted during operation so there is no reactor coolant pump oil collection system.
3.3.1-98	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel heat exchanger components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.
3.3.1-99	Copper alloy, aluminum piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for copper alloy and aluminum components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-100	Stainless steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.
3.3.1-101	Aluminum heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	This item was not used. There are no aluminum heat exchanger tubes exposed to lube oil with an intended function of heat transfer in systems in the scope of license renewal.
3.3.1-102	Boral®; boron steel, and other materials (excluding Boraflex) spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water	Reduction of neutron-absorbing capacity; change in dimensions and loss of material due to effects of SFP environment	Chapter XI.M40, "Monitoring of Neutron-Absorbing Materials other than Boraflex"	No	Consistent with NUREG-1801. The change in material properties and reduction of neutron-absorbing capacity of the aluminum/boron carbide spent fuel storage rack neutron-absorbing sheets exposed to treated water will be managed by the Neutron-Absorbing Material Monitoring Program.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-103	Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to soil or concrete	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no buried concrete components in the auxiliary systems in the scope of license renewal.
3.3.1-104	HDPE, fiberglass piping, piping components, and piping elements exposed to soil or concrete	Cracking, blistering, change in color due to water absorption	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no fiberglass or HDPE components exposed to soil or concrete in the systems in the scope of license renewal.
3.3.1-105	Concrete cylinder piping, asbestos cement pipe piping, piping components, and piping elements exposed to soil or concrete	Cracking, spalling, corrosion of rebar due to exposure of rebar	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no concrete or asbestos cement components exposed to soil or concrete in the systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-106	Steel (with coating or wrapping) piping, piping components, and piping elements exposed to soil or concrete	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to soil is managed by the Buried and Underground Piping Program. There are no buried or underground steel components exposed to concrete in the auxiliary systems in the scope of license renewal.
3.3.1-107	Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no buried or underground stainless steel or nickel alloy components exposed to soil or concrete in the auxiliary systems in the scope of license renewal.
3.3.1-108	Titanium, super austenitic, aluminum, copper alloy, stainless steel, nickel alloy piping, piping components, and piping elements, bolting exposed to soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. None of the component type, material and environment combinations represented by this item apply to components in auxiliary systems included in the scope of license renewal.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-109	Steel bolting exposed to soil or concrete	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. Loss of material for steel bolting exposed to soil is managed by the Buried and Underground Piping Program. There is no steel bolting embedded in concrete in systems in the scope of license renewal.
3.3.1-109.5	Underground aluminum, copper alloy, stainless steel, nickel alloy and steel piping, piping components, and piping elements	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. Loss of material for underground steel components is managed by the Buried and Underground Piping Program. There are no underground aluminum, copper alloy, nickel alloy or stainless steel components in auxiliary systems in the scope of license renewal.
3.3.1-110	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	This item was not used. Stainless steel components of the auxiliary systems subject to evaluation under the BWR Stress Corrosion Cracking Program were reviewed as part of the Class 1 reactor coolant pressure boundary.
3.3.1-111	Steel structural steel exposed to air – indoor, uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	This item was not used. Aging management review results for structural steel components are presented in and compared to NUREG-1801 items in Section 3.5.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-112	Steel piping, piping components, and piping elements exposed to concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Consistent with NUREG-1801. Embedded steel components are in concrete that is designed and constructed in accordance with ACI and ASTM standards, which provide a good-quality, relatively high strength, dense, low-permeability concrete. This design is sufficient to preclude embedded steel corrosion for concrete not exposed to an aggressive environment. Operating experience indicates no significant aging related degradation of this concrete.
3.3.1-113	Aluminum piping, piping components, and piping elements exposed to air – dry (internal/external), air – indoor, uncontrolled (internal/external), air – indoor, controlled (external), gas	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-114	Copper alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external), air – dry, gas	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.
3.3.1-115	PWR only				
3.3.1-116	Galvanized steel piping, piping components, and piping elements exposed to air - indoor, uncontrolled	None	None	NA – No AEM or AMP	This item was not used. Galvanized (zinc) coating applied to some steel components is not credited for corrosion protection for license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-117	Glass piping elements exposed to air – indoor, uncontrolled (external), lubricating oil, closed-cycle cooling water, air – outdoor, fuel oil, raw water, treated water, treated borated water, air with borated water leakage, condensation (internal/external) gas	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.
3.3.1-118	Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external)	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-119	Nickel alloy, [polyvinyl chloride] PVC, glass piping, piping components, and piping elements exposed to air with borated water leakage, air – indoor, uncontrolled, condensation (internal), waste water	None	None	NA – No AEM or AMP	Consistent with NUREG-1801 for glass components exposed to waste water. Other material-environment combinations encompassed by this item are not applicable to auxiliary system components in the scope of license renewal.
3.3.1-120	Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external), air – indoor, uncontrolled (external), air with borated water leakage, concrete, air – dry, gas	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-121	Steel piping, piping components, and piping elements exposed to air – indoor, controlled (external), air – dry, gas	None	None	NA – No AEM or AMP	Consistent with NUREG-1801 for steel components exposed to gas. There are no steel auxiliary system components exposed to other environments represented by this item in the scope of license renewal.
3.3.1-122	Titanium heat exchanger components, piping, piping components, and piping elements exposed to air – indoor, uncontrolled or air – outdoor	None	None	NA – No AEM or AMP	This item was not used. There are no titanium components included in systems in the scope of license renewal.
3.3.1-123	Titanium (ASTM Grades 1,2, 7, 11, or 12 that contains > 5% aluminum or more than 0.20% oxygen or any amount of tin) heat exchanger components other than tubes, piping, piping components, and piping elements exposed to raw water	None	None	NA – No AEM or AMP	This item was not used. There are no titanium components included in systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-124	Stainless steel, steel (with stainless steel or nickel-alloy cladding) spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components, and piping elements; exposed to treated water >60°C (> 140°F), treated borated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Cracking of stainless steel fuel storage rack components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage cracking.
3.3.1-125	Steel (with stainless steel cladding) stainless steel spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components, and piping elements; exposed to treated water, treated borated water	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for stainless steel fuel storage rack components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-126	Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated), raw water	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801 for some components. Loss of material due to erosion is managed by the Flow-Accelerated Corrosion Program for components exposed to treated water. For components exposed to raw water, the Service Water Integrity Program manages loss of material due to erosion.
3.3.1-127	Metallic piping, piping components, and tanks exposed to raw water or waste water	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific	Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on recurring internal corrosion in the development of the license renewal application. (See Section 3.3.2.2.8)

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-128	Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to general (steel only), pitting, or crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M29, "Aboveground Metallic Tanks"	No	This item was not used. There are no stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the auxiliary systems. Loss of material for steel tanks in outdoor air is addressed in Item 3.3.1-67.
3.3.1-129	Steel tanks exposed to soil or concrete; air-indoor uncontrolled, raw water, treated water, waste water, condensation	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Consistent with NUREG-1801. Loss of material for steel tanks exposed to soil is managed by the Aboveground Metallic Tanks Program. There are no steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the auxiliary systems exposed to other environments listed for this item.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-130	Metallic sprinklers exposed to air-indoor controlled, air-indoor uncontrolled, air-outdoor, moist air, condensation, raw water, treated water	Loss of material due to general (where applicable), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	This item was not used. Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on flow blockage of water-based fire protection system piping in the development of the license renewal application.
3.3.1-131	Steel, stainless steel, copper alloy, or aluminum fire water system piping, piping components and piping elements exposed to air-indoor uncontrolled (internal), air-outdoor (internal), or condensation (internal)	Loss of material due to general (steel, and copper alloy only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	This item was not used. Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on flow blockage of water-based fire protection system piping in the development of the license renewal application.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-132	Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor	Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only)	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only)	No	Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on corrosion under insulation in the development of the license renewal application.
3.3.1-133	Underground HDPE piping, piping components, and piping elements in an air-indoor uncontrolled or condensation (external) environment	Cracking, blistering, change in color due to water absorption	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There are no underground HDPE piping components in the auxiliary systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-134	Steel, stainless steel, or copper alloy piping, piping components, and piping elements, and heat exchanger components exposed to a raw water environment (for nonsafety-related components not covered by NRC GL 89-13)	Loss of material due to general (steel and copper alloy only), pitting, crevice, and microbiologically influenced corrosion, fouling that leads to corrosion	Chapter XI.MI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Loss of material for steel and stainless steel components (nonsafety-related components not covered by NRC GL 89-13) exposed to raw water is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. There are no nonsafety-related copper alloy components exposed to open cycle cooling water in the auxiliary systems in the scope of license renewal.
3.3.1-135	Steel or stainless steel pump casings submerged in a waste water (internal and external) environment	Loss of material due to general (steel only), pitting, crevice, and microbiologically influenced corrosion	Chapter XI.MI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no steel or stainless steel pump casings exposed internally and externally to waste water in the auxiliary systems in the scope of license renewal.

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-136	Steel, stainless steel or aluminum fire water storage tanks exposed to air-indoor uncontrolled, air-outdoor, condensation, moist air, raw water, treated water	Loss of material due to general (steel only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M27, "Fire Water System"	No	This item was not used. Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on flow blockage of water-based fire protection system piping in the development of the license renewal application.
3.3.1-137	Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water, treated borated water	Loss of material due to general (steel only) pitting and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	This line was not used. There are no steel, stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water in the auxiliary systems.

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

Generic Notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

301. The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

302. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

303. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program.

304. These components have openings that expose the internal surfaces to outdoor air. Because the internal and external surfaces are exposed to the same environments, aging effects of the internal surfaces can be inferred from external surface conditions.

305. For the purposes of evaluating selective leaching, this environment can be considered equivalent to the NUREG-1801 environment.

306. The (int) and (ext) environment designations refer to the nominal internal and external surfaces of the component and may not be consistent with the internal and external environment designations used in NUREG-1801. Consequently, an air or condensation (ext) environment for a component contained within a duct or other enclosure can correspond directly to a NUREG-1801 air or condensation (internal) environment.

307. The steam environment for this component type is produced by the auxiliary boiler system and is equivalent to closed cycle cooling water.

308. This treated water is equivalent to the NUREG-1801 raw water (potable) environment.

309. The steam environment for this component type is produced from and is equivalent to treated water for the purposes of evaluating loss of material due to erosion.

Table 3.3.2-1
Control Rod Drive System
Summary of Aging Management Evaluation

Table 3.3.2-1: Control Rod Drive System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Accumulator	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Accumulator	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	C
Accumulator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Accumulator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Accumulator	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Accumulator	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B

Table 3.3.2-1: Control Rod Drive System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Filter	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Filter	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Filter	Filtration	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 301
Filter	Filtration	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Filter	Filtration	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 301
Filter	Filtration	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 301
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-1: Control Rod Drive System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
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	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Rupture disc	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Rupture disc	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A

Table 3.3.2-1: Control Rod Drive System								
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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
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	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	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 301

Table 3.3.2-1: Control Rod Drive System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-2
Standby Liquid Control System
Summary of Aging Management Evaluation

Table 3.3.2-2: Standby Liquid Control System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Heater housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Heater housing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-2: Standby Liquid Control 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	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Tank	Pressure boundary	Stainless steel	Concrete (ext)	None	None	VII.J.AP-19	3.3.1-120	C
Tank	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	C, 301
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301

Table 3.3.2-2: Standby Liquid Control System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301

Table 3.3.2-3
Service Water Systems
Summary of Aging Management Evaluation

Table 3.3.2-3: Service Water Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of preload	Bolting Integrity	VII.I.AP-264	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Stainless steel	Raw water (ext)	Loss of material	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Stainless steel	Raw water (ext)	Loss of preload	Bolting Integrity	VII.I.AP-264	3.3.1-15	B

Table 3.3.2-3: Service Water 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	Elastomer	Air – outdoor (ext)	Change in material properties	External Surfaces Monitoring	–	–	G
Flex connection	Pressure boundary	Elastomer	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	–	–	G
Flex connection	Pressure boundary	Elastomer	Air – outdoor (ext)	Loss of material – wear	External Surfaces Monitoring	–	–	G
Flex connection	Pressure boundary	Elastomer	Gas (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Flex connection	Pressure boundary	Elastomer	Gas (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Flex connection	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	VII.C1.AP-209	3.3.1-4	A
Flex connection	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.C1.AP-221	3.3.1-6	A
Flex connection	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G

Table 3.3.2-3: Service Water Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54 VII.C1.A-409	3.3.1-40 3.3.1-126	A E
Nozzle	Flow control	Copper alloy	Air – outdoor (ext)	Loss of material	Service Water Integrity	VII.I.AP-159	3.3.1-81	E
Nozzle	Flow control	Copper alloy	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-196 VII.C1.A-409	3.3.1-36 3.3.1-126	A E
Orifice	Pressure boundary Flow control	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	–	G
Orifice	Pressure boundary Flow control	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54 VII.C1.A-409	3.3.1-40 3.3.1-126	A E
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Service Water Integrity	VII.I.A-78	3.3.1-78	E
Piping	Pressure boundary	Carbon steel	Concrete (ext)	None	None	VII.J.AP-282	3.3.1-112	A
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A

Table 3.3.2-3: Service Water Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	A, 302
Piping	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	C
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-194 VII.C1.A-409	3.3.1-37 3.3.1-126	C E
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VII.C1.AP-198	3.3.1-106	A
Piping	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Piping	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54 VII.C1.A-409	3.3.1-40 3.3.1-126	A E
Pump casing	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	C
Pump casing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-194 VII.C1.A-409	3.3.1-37 3.3.1-126	C E
Pump casing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1.AP-109	3.3.1-79	C

Table 3.3.2-3: Service Water 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	Copper alloy	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-196 VII.C1.A-409	3.3.1-36 3.3.1-126	A E
Thermowell	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Thermowell	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54 VII.C1.A-409	3.3.1-40 3.3.1-126	A E
Tubing	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	VII.C1.AP-209	3.3.1-4	A
Tubing	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.C1.AP-221	3.3.1-6	A
Tubing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54 VII.C1.A-409	3.3.1-40 3.3.1-126	A E
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	A, 302

Table 3.3.2-3: Service Water 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	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	C
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-194 VII.C1.A-409	3.3.1-37 3.3.1-126	C E
Valve body	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	VII.C1.AP-209	3.3.1-4	A
Valve body	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.C1.AP-221	3.3.1-6	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54 VII.C1.A-409	3.3.1-40 3.3.1-126	A E

Table 3.3.2-4
Fuel Pool Cooling and Cleanup System
Summary of Aging Management Evaluation

Table 3.3.2-4: Fuel Pool Cooling and Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure Boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Neutron absorber	Neutron absorption	Aluminum/boron carbide	Treated water (ext)	Change in material properties	Neutron-Absorbing Material Monitoring	VII.A2.AP-236	3.3.1-102	A
Neutron absorber	Neutron absorption	Aluminum/boron carbide	Treated water (ext)	Loss of material	Neutron-Absorbing Material Monitoring	VII.A2.AP-236	3.3.1-102	A
Neutron absorber	Neutron absorption	Aluminum/boron carbide	Treated water (ext)	Reduction in neutron absorption capacity	Neutron-Absorbing Material Monitoring	VII.A2.AP-236	3.3.1-102	A
Neutron absorber	Neutron absorption	Boron carbide / elastomer	Treated water (ext)	Change in material properties	Boraflex Monitoring	VII.A2.A-87	3.3.1-51	A
Neutron absorber	Neutron absorption	Boron carbide / elastomer	Treated water (ext)	Reduction in neutron absorption capacity	Boraflex Monitoring	VII.A2.A-87	3.3.1-51	A

Table 3.3.2-4: Fuel Pool Cooling and Cleanup System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Concrete (ext)	None	None	VII.J.AP-19	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	VII.A4.AP-110	3.3.1-25	A, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.A4.AP-110	3.3.1-25	A, 301
Rack (new fuel)	SSR	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	C
Rack	SSR	Stainless steel	Treated water > 140°F (ext)	Cracking	Water Chemistry Control – BWR	VII.A2.A-96	3.3.1-124	A, 301
Rack	SSR	Stainless steel	Treated water > 140°F (ext)	Loss of material	Water Chemistry Control – BWR	VII.A2.A-98	3.3.1-125	A, 301

Table 3.3.2-4: Fuel Pool Cooling and Cleanup System								
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	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301

Table 3.3.2-5
Emergency Equipment Cooling Water System
Summary of Aging Management Evaluation

Table 3.3.2-5: Emergency Equipment Cooling Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Flex connection	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Flex connection	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H

Table 3.3.2-5: Emergency Equipment Cooling Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Flex connection	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Flex connection	Pressure boundary	Nickel alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Flex connection	Pressure boundary	Nickel alloy	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Flex connection	Pressure boundary	Nickel alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	--	--	G
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	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Flex connection	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Flex connection	Pressure boundary	Stainless steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Flex connection	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	A

Table 3.3.2-5: Emergency Equipment Cooling Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Flow element	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	A
Flow element	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	A
Heat exchanger (end cover)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (end cover)	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54	3.3.1-40	C
Heat exchanger (end cover)	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	C

Table 3.3.2-5: Emergency Equipment Cooling Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (plates)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (plates)	Heat transfer	Stainless steel	Raw water (int)	Fouling	Service Water Integrity	VII.C1.AP-187	3.3.1-42	C
Heat exchanger (plates)	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.A-54	3.3.1-40	C
Heat exchanger (plates)	Heat transfer	Stainless steel	Treated water (int)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-188	3.3.1-50	C
Heat exchanger (plates)	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	C
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	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A

Table 3.3.2-5: Emergency Equipment Cooling Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Piping	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Piping	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	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-5: Emergency Equipment Cooling Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Thermowell	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	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
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	A
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Valve body	Pressure boundary	Aluminum	Gas (int)	None	None	VII.J.AP-37	3.3.1-113	A

Table 3.3.2-5: Emergency Equipment Cooling Water System								
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	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Valve body	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	A

Table 3.3.2-6
Compressed Air Systems
Summary of Aging Management Evaluation

Table 3.3.2-6: Compressed Air Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Accumulator	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Chamber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Chamber	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Condenser	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Condenser	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Dryer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A

Table 3.3.2-6: Compressed Air Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Dryer	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Condensation (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Flex connection	Pressure boundary	Elastomer	Condensation (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Flex connection	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	VII.J.AP-16	3.3.1-118	A
Flex connection	Pressure boundary	Nickel alloy	Condensation (int)	Loss of material	Compressed Air Monitoring	–	–	F

Table 3.3.2-6: Compressed Air 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	Condensation (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Flex connection	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Flow element	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary Flow control	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	C
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D, 306

Table 3.3.2-6: Compressed Air Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tube sheet)	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	C
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Condensation (int)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	D
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (ext)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	C
Manifold	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Manifold	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Moisture separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A

Table 3.3.2-6: Compressed Air Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Moisture separator	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary Flow control	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Regulator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Regulator	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B

Table 3.3.2-6: Compressed Air Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Strainer	Filtration	Copper alloy	Condensation (ext)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	B
Strainer	Filtration	Copper alloy	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	B
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Strainer housing	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Thermowell	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-6: Compressed Air Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Trap	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Trap	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
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	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Valve body	Pressure boundary	Aluminum	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.F1.AP-142	3.3.1-92	E
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-6: Compressed Air 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	Copper alloy	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	B
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	B
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B

Table 3.3.2-7
Fire Protection – Water System
Summary of Aging Management Evaluation

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VII.I.AP-241	3.3.1-109	A
Bolting	Pressure boundary	Carbon steel	Soil (ext)	Loss of preload	Bolting Integrity	VII.I.AP-242	3.3.1-14	B
Bolting	Pressure boundary	Stainless steel	Raw water (ext)	Loss of material	Bolting Integrity	--	--	H
Bolting	Pressure boundary	Stainless steel	Raw water (ext)	Loss of preload	Bolting Integrity	VII.I.AP-264	3.3.1-15	B
Expansion joint	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Expansion joint	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	C
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	Raw water (int)	Loss of material	Fire Water System	VII.G.A-55	3.3.1-66	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.G.AP-41	3.3.1-80	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	C
Heat exchanger (fins)	Heat transfer	Copper alloy	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	C, 302
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.G.AP-41	3.3.1-80	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.G.AP-127	3.3.1-97	C, 302

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	C
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Raw water (ext)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	C
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	C, 302
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Lube oil (ext)	Loss of material	Oil Analysis	VII.G.AP-133	3.3.1-99	C, 302
Heat exchanger (tubes)	Heat transfer	Copper alloy	Raw water (int)	Fouling	Periodic Surveillance and Preventive Maintenance	VII.C1.A-72	3.3.1-42	E
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	C

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Heat transfer	Copper alloy	Treated water (ext)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	C
Hydrant	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Fire Water System	VII.G.AP-149	3.3.1-63	A
Hydrant	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Hydrant	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VII.G.AP-198	3.3.1-106	A
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	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air – outdoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	C
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VII.G.AP-198	3.3.1-106	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Pump casing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Screen	Filtration	Stainless steel	Raw water (ext)	Loss of material	Fire Water System	VII.G.A-55	3.3.1-66	A
Screen	Filtration	Stainless steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-55	3.3.1-66	A

Table 3.3.2-7: Fire Protection – Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Silencer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Silencer	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	C
Sprinkler	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Sprinkler	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	VII.J.AP-144	3.3.1-114	A
Sprinkler	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	A
Sprinkler	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – outdoor (int)	Loss of material	External Surfaces Monitoring	–	–	G

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Sprinkler	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	A
Sprinkler	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Selective Leaching	VII.G.A-47	3.3.1-72	A
Strainer	Filtration	Stainless steel	Raw water (ext)	Loss of material	Fire Water System	VII.G.A-55	3.3.1-66	A
Strainer	Filtration	Stainless steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-55	3.3.1-66	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	A

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Selective Leaching	VII.G.A-47	3.3.1-72	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Tubing	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-55	3.3.1-66	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	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Valve body	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VII.G.AP-198	3.3.1-106	A
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy	Raw water (int)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-7: Fire Protection – Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Selective Leaching	VII.G.A-47	3.3.1-72	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Valve body	Pressure boundary	Gray cast iron	Raw water (int)	Loss of material	Selective Leaching	VII.G.A-51	3.3.1-72	A
Valve body	Pressure boundary	Gray cast iron	Soil (ext)	Loss of material	Buried and Underground Piping	VII.G.AP-198	3.3.1-106	A
Valve body	Pressure boundary	Gray cast iron	Soil (ext)	Loss of material	Selective Leaching	VII.G.A-02	3.3.1-72	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Fire Water System	VII.G.A-55	3.3.1-66	A

Table 3.3.2-8
Fire Protection – CO_2 and Halon System
Summary of Aging Management Evaluation

Table 3.3.2-8: Fire Protection – CO_2 and Halon System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Flex connection	Pressure boundary	Teflon	Air – indoor (ext)	None	None	--	--	F
Flex connection	Pressure boundary	Teflon	Gas (int)	None	None	--	--	F
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Gas (ext)	None	None	VII.J.AP-9	3.3.1-114	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	C

Table 3.3.2-8: Fire Protection – CO_2 and Halon System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Nozzle	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Nozzle	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	VII.J.AP-144	3.3.1-114	A
Nozzle	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Nozzle	Pressure boundary Flow control	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Odorizer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
Odorizer	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A

Table 3.3.2-8: Fire Protection – CO_2 and Halon System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Fire Protection	VII.I.A-78	3.3.1-78	E
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
Sight glass	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J.AP-48	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Gas (int)	None	None	VII.J.AP-98	3.3.1-117	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	C
Tank	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	A

Table 3.3.2-8: Fire Protection – CO_2 and Halon System								
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	Air – indoor (ext)	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Fire Protection	VII.I.A-78	3.3.1-78	E
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A

Table 3.3.2-9
Combustion Turbine Generator System
Summary of Aging Management Evaluation

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Accumulator	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Annulus	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Annulus	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Assembly	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Assembly	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Bellows	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Bellows	Pressure boundary	Stainless steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of material	Bolting Integrity	–	–	G
Bolting	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of preload	Bolting Integrity	–	–	G
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Cover	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Cover	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Damper	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External Surfaces Monitoring	V.B.E-25	3.2.1-44	E
Damper	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A

Table 3.3.2-9: Combustion Turbine Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Duct	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Ejector	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Ejector	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Filter	Filtration	Glass	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	–	–	H
Filter	Filtration	Glass	Air – indoor (int)	None	None	VII.J.AP-48	3.3.1-117	A
Filter	Filtration	Stainless steel	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	–	–	H
Filter	Filtration	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Filter housing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Loss of material – wear	External Surfaces Monitoring	VII.F1.AP-113	3.3.1-82	C

Table 3.3.2-9: Combustion Turbine Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Flex connection	Pressure boundary	Elastomer	Air – indoor (int)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (int)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (int)	Loss of material – wear	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	C
Flex connection	Pressure boundary	Elastomer	Fuel oil (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Flex connection	Pressure boundary	Elastomer	Fuel oil (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Flex connection	Pressure boundary	Elastomer	Lube oil (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Flex connection	Pressure boundary	Elastomer	Lube oil (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	C
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	C
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-41	3.3.1-80	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-40	3.3.1-80	A
Heat exchanger (end channel)	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	C
Heat exchanger (fins)	Heat transfer	Aluminum	Air – outdoor (ext)	Fouling	External Surfaces Monitoring	--	--	G
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-41	3.3.1-80	A

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-131	3.3.1-98	A, 302
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Air – indoor (int)	None	None	VII.J.AP-144	3.3.1-114	C
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	C, 302
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – indoor (ext)	Fouling	Periodic Surveillance and Preventive Maintenance	–	–	G
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Air – indoor (ext)	Loss of material – wear	Periodic Surveillance and Preventive Maintenance	–	–	H

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – outdoor (ext)	Fouling	External Surfaces Monitoring	--	--	G
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Treated water (int)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	C
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	C, 302
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	C, 302
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material – wear	Periodic Surveillance and Preventive Maintenance	--	--	H

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	C
Hood	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Hood	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Housing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Housing	Pressure boundary	Carbon steel	Air – outdoor (int)	Loss of material	External Surfaces Monitoring	--	--	G, 304

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Housing	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Housing	Pressure boundary	Stainless steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Liner	Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Liner	Pressure boundary	Stainless steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Nozzle	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Nozzle	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Nozzle	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
Orifice	Pressure boundary Flow control	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Orifice	Pressure boundary Flow control	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Air – indoor (int)	None	None	VII.J.AP-144	3.3.1-114	A
Orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	A
Orifice	Pressure boundary Flow control	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A
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	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Piping	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VII.H1.AP-198	3.3.1-106	C
Piping	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	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Plenum	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Plenum	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
Pump casing	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302

Table 3.3.2-9: Combustion Turbine 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	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
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	A
Pump casing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Pump casing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Screen	Filtration	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Screen	Filtration	Carbon steel	Air – outdoor (int)	Loss of material	External Surfaces Monitoring	–	–	G, 304
Screen	Filtration	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Screen	Filtration	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Separator	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Separator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Separator	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Silencer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Silencer	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Silencer	Pressure boundary	Carbon steel	Air – outdoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Silencer	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Strainer	Filtration	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Strainer	Filtration	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Strainer	Filtration	Stainless steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Strainer	Filtration	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Strainer housing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	C, 302
Tank	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	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-9: *Combustion Turbine Generator System*								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	VII.H2.AP-209	3.3.1-4	A
Thermowell	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-221	3.3.1-6	A
Thermowell	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Tube	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tube	Pressure boundary	Stainless steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
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

Table 3.3.2-9: Combustion Turbine Generator System								
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 – outdoor (ext)	Cracking	External Surfaces Monitoring	VII.H2.AP-209	3.3.1-4	A
Tubing	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-221	3.3.1-6	A
Tubing	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-136	3.3.1-71	A, 303
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Turbine casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Turbine casing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C

Table 3.3.2-9: Combustion Turbine Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Turbine casing	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Turbocharger	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Turbocharger	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Turbocharger	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Valve body	Pressure boundary	Aluminum	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-162	3.3.1-99	A, 302
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	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C

Table 3.3.2-9: Combustion Turbine Generator System								
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	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Valve body	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
Valve body	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Valve body	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	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-132	3.3.1-69	A, 303

Table 3.3.2-9: Combustion Turbine Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-136	3.3.1-71	A, 303
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302

**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**
Blower housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Blower housing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.A-23	3.3.1-89	A
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Bolting Integrity	–	–	H

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**
Bolting	Pressure boundary	Carbon steel	Raw water (ext)	Loss of preload	Bolting Integrity	VII.I.AP-264	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Expansion joint	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Expansion joint	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Expansion joint	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	*TLAA – metal fatigue*	–	–	H
Expansion joint	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Expansion joint	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Expansion joint	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Expansion joint	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	VII.H2.AP-209	3.3.1-4	A
Expansion joint	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-221	3.3.1-6	A
Expansion joint	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G

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
Expansion joint	Pressure boundary	Stainless steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Expansion joint	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.H2.AP-55	3.3.1-41	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Filter housing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Flow element	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.H2.AP-55	3.3.1-41	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A

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**
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-183	3.3.1-38	C
Heat exchanger (fins)	Heat transfer	Aluminum	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-41	3.3.1-80	A
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.H2.AP-41	3.3.1-80	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-131	3.3.1-98	A, 302
Heat exchanger (shell)	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	C

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
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	C, 302
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (ext)	Loss of material	Selective Leaching	VII.H2.A-47	3.3.1-72	C
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1.AP-179	3.3.1-38	C
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	C
Heat exchanger (tube sheet)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	C
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	C, 302

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
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	C, 302
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material – wear	Periodic Surveillance and Preventive Maintenance	–	–	H
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Raw water (int)	Fouling	Service Water Integrity	VII.C1.A-72	3.3.1-42	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-179	3.3.1-38	C
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (ext)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (ext)	Loss of material – wear	Periodic Surveillance and Preventive Maintenance	–	–	H

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
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-205	3.3.1-50	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	C
Heater housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heater housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Heater housing	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	A
Muffler	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Muffler	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A

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**
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Orifice	Pressure boundary Flow control	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
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)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-34	3.3.1-2	C
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A

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**
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	C
Piping	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	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Pump casing	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	C

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	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	C
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	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
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	A
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J.AP-48	3.3.1-117	A

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**
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	VII.J.AP-15	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J.AP-166	3.3.1-117	A
Silencer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Silencer	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Strainer	Filtration	Stainless steel	Condensation (ext)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D
Strainer	Filtration	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D
Strainer	Filtration	Stainless steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Strainer	Filtration	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Strainer housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302

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**
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	C, 302
Tank	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	A
Thermowell	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Thermowell	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Thermowell	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	A
Thermowell	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

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**
Tubing	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A
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
Tubing	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	–	G
Tubing	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.H2.AP-55	3.3.1-41	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C

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**
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Turbocharger	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Turbocharger	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Turbocharger	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2.AP-104	3.3.1-88	A
Turbocharger	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Turbocharger	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	A
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Valve body	Pressure boundary	Aluminum	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.F1.AP-142	3.3.1-92	E

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
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	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	C
Valve body	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	A
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	D
Valve body	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A

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**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	D
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.H2.AP-43	3.3.1-72	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.H2.AP-199	3.3.1-46	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D

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**
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-138	3.3.1-100	A, 302
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Service Water Integrity	VII.H2.AP-55	3.3.1-41	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C

Table 3.3.2-11
Heating, Ventilation and Air Conditioning Systems
Summary of Aging Management Evaluation

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-126	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-263	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Condenser housing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Condenser housing	Pressure boundary	Carbon steel	Air – outdoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Damper housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Damper housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Duct	Pressure boundary	Carbon steel	Concrete (ext)	None	None	VII.J.AP-282	3.3.1-112	A

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Fan housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Filter housing	Pressure boundary	Aluminum	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	--	--	H
Filter housing	Pressure boundary	Aluminum	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-256	3.3.1-81	A
Filter housing	Pressure boundary	Aluminum	Gas (int)	None	None	VII.J.AP-37	3.3.1-113	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Filter housing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	C
Flex connection	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	C

Table 3.3.2-11: Heating, Ventilation and Air Conditioning 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	Aluminum	Air – indoor (int)	None	None	VII.J.AP-135	3.3.1-113	C
Flex connection	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	C
Flex connection	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F2.AP-102	3.3.1-76	A
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F2.AP-102	3.3.1-76	A
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Loss of material – wear	External Surfaces Monitoring	VII.F2.AP-113	3.3.1-82	A
Flex connection	Pressure boundary	Elastomer	Air – indoor (int)	Change in material properties	External Surfaces Monitoring	VII.F2.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (int)	Cracking	External Surfaces Monitoring	VII.F2.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (int)	Loss of material – wear	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-103	3.3.1-96	A

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (end channel)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	C
Heat exchanger (end channel)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
Heat exchanger (end channel)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (end channel)	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Heat exchanger (end channel)	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	C
Heat exchanger (fins)	Heat transfer	Aluminum	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (fins)	Heat transfer	Aluminum	Air – outdoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (fins)	Heat transfer	Copper alloy	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	–	G
Heat exchanger (fins)	Heat transfer	Copper alloy	Condensation (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.AP-41	3.3.1-80	A
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – outdoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (housing)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (housing)	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-99	3.3.1-94	C, 306
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Heat exchanger (tube sheet)	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	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – outdoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G, 306
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Treated water (int)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-205	3.3.1-50	A
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
Heat exchanger (tubes)	Heat transfer	Stainless steel	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (tubes)	Heat transfer	Stainless steel	Condensation (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.AP-99	3.3.1-94	C, 306
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water (int)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-188	3.3.1-50	C
Heat exchanger (tubes)	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	C
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	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C

Table 3.3.2-11: Heating, Ventilation and Air Conditioning Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A, 307
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Pump casing	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Pump casing	Pressure boundary	Aluminum	Air – indoor (int)	None	None	VII.J.AP-135	3.3.1-113	A
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Tubing	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	A
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	A

Table 3.3.2-11: Heating, Ventilation and Air Conditioning 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	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A, 307
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-12
Control Center Heating, Ventilation and Air Conditioning System
Summary of Aging Management Evaluation

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Bolting	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	C, 302
Bolting	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of preload	Bolting Integrity	–	–	G
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Stainless steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Compressor housing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Compressor housing	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	C
Damper housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1.A-10	3.3.1-78	A
Damper housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1.A-10	3.3.1-78	A
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Duct	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1.A-10	3.3.1-78	A
Fan housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	C
Flex connection	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	C
Flex connection	Pressure boundary	Aluminum	Air – indoor (int)	None	None	VII.J.AP-135	3.3.1-113	C
Flow element	Pressure boundary Flow control	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Flow element	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1.AP-41	3.3.1-80	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-189	3.3.1-46	A

Table 3.3.2-12: Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (fins)	Heat transfer	Aluminum	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Heat exchanger (fins)	Heat transfer	Copper alloy	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	--	--	G
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1.AP-41	3.3.1-80	A
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F1.AP-41	3.3.1-80	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	C

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	C, 302
Heat exchanger (tube sheet)	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	C
Heat exchanger (tube sheet)	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-189	3.3.1-46	A
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – indoor (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Condensation (ext)	Fouling	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G.AP-143	3.3.1-89	C, 306

Table 3.3.2-12: Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Gas (ext)	None	None	VII.J.AP-9	3.3.1-114	C
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	C, 302
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Lube oil (ext)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	C, 302
Heat exchanger (tubes)	Heat transfer	Copper alloy	Treated water (int)	Fouling	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-205	3.3.1-50	A
Heat exchanger (tubes)	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-203	3.3.1-46	A
Moisture separator	Filtration	Fiberglass	Air – indoor (ext)	None	None	--	--	G
Moisture separator	Filtration	Fiberglass	Air – indoor (int)	None	None	--	--	G

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Moisture separator	Filtration	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Moisture separator	Filtration	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
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	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Piping	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	A, 302
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	A, 302
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-202	3.3.1-45	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (ext)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	A, 302
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	A, 302
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning 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	Stainless steel	Air – indoor (int)	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 – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Rupture disc	Pressure boundary	Graphite	Air – indoor (ext)	None	None	--	--	F
Rupture disc	Pressure boundary	Graphite	Gas (int)	None	None	--	--	F
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J.AP-48	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Gas (int)	None	None	VII.J.AP-98	3.3.1-117	A
Strainer	Filtration	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Strainer	Filtration	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Strainer housing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-202	3.3.1-45	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	C
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	C, 302
Thermowell	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Thermowell	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	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Tubing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1.AP-109	3.3.1-79	A
Tubing	Pressure boundary	Copper alloy	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	A

Table 3.3.2-12:Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-199	3.3.1-46	A
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
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 302
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	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.F1.AP-127	3.3.1-97	A, 302
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-202	3.3.1-45	A

Table 3.3.2-12: Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1.AP-109	3.3.1-79	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Gas (int)	None	None	VII.J.AP-9	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.F1.AP-43	3.3.1-72	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F1.AP-199	3.3.1-46	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 302

Table 3.3.2-12: Control Center Heating, Ventilation and Air Conditioning System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	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	C

Table 3.3.2-13
Containment Atmospheric Control Systems
Summary of Aging Management Evaluation

Table 3.3.2-13:Containment Atmospheric Control Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Blower housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Blower housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Chamber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Chamber	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Cooler	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Cooler	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-13:Containment Atmospheric Control Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Flow element	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Orifice	Pressure boundary Flow control	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Orifice	Pressure boundary Flow control	Carbon steel	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
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	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-13:Containment Atmospheric Control Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Separator	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Strainer	Filtration	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Strainer	Filtration	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tubing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E

Table 3.3.2-13:Containment Atmospheric Control 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	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A

Table 3.3.2-14
Plant Drains
Summary of Aging Management Evaluation

Table 3.3.2-14:Plant Drains								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Drain	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Drain	Pressure boundary	Copper alloy	Concrete (ext)	None	None	--	--	G
Drain	Pressure boundary	Copper alloy	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	A
Drain	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Drain	Pressure boundary	Stainless steel	Concrete (ext)	None	None	VII.J.AP-19	3.3.1-120	A

Table 3.3.2-14:Plant Drains

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Drain	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
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	Concrete (ext)	None	None	VII.J.AP-282	3.3.1-112	A
Piping	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	A
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Concrete (ext)	None	None	VII.J.AP-19	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	A
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-14:Plant Drains								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Trap	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	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	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-15
Fuel Oil Systems
Summary of Aging Management Evaluation

Table 3.3.2-15:Fuel Oil Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-105	3.3.1-70	A, 303
Hose	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Hose	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303
Manifold	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Manifold	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303

Table 3.3.2-15: Fuel Oil Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Orifice	Pressure boundary Flow control	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Orifice	Pressure boundary Flow control	Aluminum	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-129	3.3.1-71	A, 303
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 – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H1.A-24	3.3.1-80	A
Piping	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-105	3.3.1-70	A, 303
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VII.H1.AP-198	3.3.1-106	A
Piping	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Piping	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	A
Piping	Pressure boundary	Copper alloy	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-132	3.3.1-69	A, 303
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-15:Fuel Oil 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	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H1.A-24	3.3.1-80	A
Pump casing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-105	3.3.1-70	A, 303
Sight glass	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H1.AP-221	3.3.1-6	A
Sight glass	Pressure boundary	Stainless steel	Air – outdoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Sight glass	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303
Strainer	Filtration	Stainless steel	Fuel oil (ext)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303
Strainer	Filtration	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-105	3.3.1-70	A, 303

Table 3.3.2-15:Fuel Oil Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Aboveground Metallic Tanks	VII.H1.A-95	3.3.1-67	A
Tank	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-78	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-105	3.3.1-70	A, 303
Tank	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Aboveground Metallic Tanks	VII.H1.A-402	3.3.1-129	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303
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 – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.H1.A-24	3.3.1-80	A
Valve body	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-105	3.3.1-70	A, 303
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-15:Fuel Oil 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	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	A
Valve body	Pressure boundary	Copper alloy	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-132	3.3.1-69	A, 303
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H1.AP-136	3.3.1-71	A, 303

Table 3.3.2-16
Primary Containment Monitoring and Leakage Detection Systems
Summary of Aging Management Evaluation

Table 3.3.2-16: Primary Containment Monitoring and Leakage Detection Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Coil	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Coil	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VII.E3.AP-112	3.3.1-20	C, 301
Coil	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
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	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Flex connection	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 301

Table 3.3.2-16:Primary Containment Monitoring and Leakage Detection 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	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	C, 301
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Housing	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	C
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-16:Primary Containment Monitoring and Leakage Detection Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
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	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Plate-out	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 301
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	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
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 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	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-16:Primary Containment Monitoring and Leakage Detection Systems								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Thermowell	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 301
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 301
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	C, 301
Trap	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Trap	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	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

Table 3.3.2-16:Primary Containment Monitoring and Leakage Detection 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	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	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 301
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
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	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 301
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-16: Primary Containment Monitoring and Leakage Detection 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	Stainless steel	Air – indoor (int)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	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
Valve body	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 301
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Cooler housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-131	3.3.1-98	C, 302
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 302
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301

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**
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 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	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Piping	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

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**
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
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	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301

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**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-2
Standby Liquid Control System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-2: Standby Liquid Control 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Piping	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
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-2: Standby Liquid Control 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	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Tank	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	C, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Valve body	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Valve body	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-130	3.3.1-25	C, 301
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-17-2: Standby Liquid Control 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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
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	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Sodium pentaborate solution (int)	Loss of material	Water Chemistry Control – BWR	VII.E2.AP-141	3.3.1-25	A, 301
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-3
Process Radiation Monitoring System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-3: Process Radiation Monitoring 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	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G
Piping	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F1.AP-109	3.3.1-79	C
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	C
Sight glass	Pressure boundary	Glass	Condensation (ext)	None	None	VII.J.AP-97	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Waste water (int)	None	None	VII.J.AP-277	3.3.1-119	A
Tank	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	--	G

Table 3.3.2-17-3: Process Radiation Monitoring 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**
Tank	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-4
Radioactive Waste System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-4: Radioactive Waste 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Flow element	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
Heat exchanger (bonnet)	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	C
Heat exchanger (bonnet)	Pressure boundary	Copper alloy	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	C
Heat exchanger (shell)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	C

Table 3.3.2-17-4: Radioactive Waste 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**
Heat exchanger (shell)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	C
Heat exchanger (shell)	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Selective Leaching	VII.E1.AP-65	3.3.1-72	C, 305
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
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	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-4: Radioactive Waste 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	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	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
Separator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Separator	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	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
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	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

Table 3.3.2-17-4: Radioactive Waste 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	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
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	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Selective Leaching	VII.E1.AP-65	3.3.1-72	C, 305
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-5
Reactor Water Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-5: Reactor Water Cleanup 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	A, 301
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Filter housing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-17-5: Reactor Water Cleanup 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**
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.E3.AP-189	3.3.1-46	A
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	A

Table 3.3.2-17-5: Reactor Water Cleanup 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**
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 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	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	Flow-Accelerated Corrosion	VIII.D2.S-16 VII.E3.A-408	3.4.1-5 3.3.1-126	C A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	A, 301
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	C
Piping	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
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301

Table 3.3.2-17-5: Reactor Water Cleanup 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 > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	A, 301
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Strainer housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	A
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	A, 301

Table 3.3.2-17-5: Reactor Water Cleanup 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**
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	A, 301
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
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	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	Flow-Accelerated Corrosion	VIII.D2.S-16 VII.E3.A-408	3.4.1-5 3.3.1-126	C A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	A, 301

Table 3.3.2-17-5: Reactor Water Cleanup 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	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	A, 301
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-6
Fuel Pool Cooling and Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-6: Fuel Pool Cooling and Cleanup 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-17-6: Fuel Pool Cooling and Cleanup 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**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.A4.AP-189	3.3.1-46	A
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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Piping	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
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4.AP-110	3.3.1-25	A, 301
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301

Table 3.3.2-17-6: Fuel Pool Cooling and Cleanup 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**
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Sight glass	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J.AP-14	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J.AP-51	3.3.1-117	A
Sight glass	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Sight glass	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4.AP-110	3.3.1-25	A, 301
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.A4.AP-110	3.3.1-25	A, 301
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-17-6: Fuel Pool Cooling and Cleanup 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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
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

Table 3.3.2-17-7
Torus Water Management System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-7: Torus Water Management 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301

Table 3.3.2-17-7: Torus Water Management 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	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
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Screen	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Screen	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
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

Table 3.3.2-17-8
Local Panels and Racks System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-8: Local Panels and Racks 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Piping	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Piping	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	C
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 302
Piping	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	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-17-8: Local Panels and Racks 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	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 302
Valve body	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	C

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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Chiller housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Chiller housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	C
Coil	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	C
Coil	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.E1.AP-203	3.3.1-46	C
Condenser (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Condenser (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B1.SP-71	3.4.1-14	C, 301

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
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Cooler housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	C
Cooler housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Cooler housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	C
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	C
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	C
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	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	C

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**
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	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	C
Heater housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heater housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.E3.AP-191	3.3.1-47	C
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	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	C
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	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15 VII.E3.A-408	3.4.1-5 3.3.1-126	C C, 309

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**
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 301
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	C
Piping	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
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VII.E3.A-408	3.3.1-126	C, 309
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G

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**
Piping	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	C
Piping	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	C
Recombiner	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Recombiner	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Recombiner	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G

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
Rupture disc	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Rupture disc	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	C
Separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Separator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	C
Separator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Separator	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	C
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	C

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**
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Tank	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	C
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	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	C
Trap	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Trap	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	C
Trap	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

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	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	C
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
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	C
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	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 301
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

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**
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	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	C

**Table 3.3.2-17-10
Potable Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation**

Table 3.3.2-17-10: 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	C, 308
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	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	C, 308
Piping	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-17-10: 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	Copper alloy	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-271	3.3.1-93	C, 308
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	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	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	C, 308
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-271	3.3.1-93	C, 308
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	C, 305

Table 3.3.2-17-10: 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**
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

Table 3.3.2-17-11
Process Sampling System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-11: Process Sampling 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Chiller housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Chiller housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Chiller housing	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Cooler housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Cooler housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C

Table 3.3.2-17-11: Process Sampling 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**
Cooler housing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C
Cooler housing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Cooler housing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Cooler housing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-275	3.3.1-95	E
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Filter housing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 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	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	C, 301

Table 3.3.2-17-11: Process Sampling 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	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Piping	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Piping	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 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 >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Pump casing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
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	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	V.D2.E-10	3.2.1-1	C

Table 3.3.2-17-11: Process Sampling 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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-12
Post-Accident Sampling System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-12: Post-Accident Sampling 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Chamber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Chamber	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Chamber	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Coil	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Coil	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 301
Cooler housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-17-12: Post-Accident Sampling 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**
Cooler housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	C
Cooler housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-140	3.3.1-22	C, 301
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Piping	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Piping	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 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 >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Pump casing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J.AP-14	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J.AP-51	3.3.1-117	A

Table 3.3.2-17-12: Post-Accident Sampling 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**
Sight glass	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Sight glass	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Sight glass	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Sight glass	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Tank	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Tank	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Trap	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Trap	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Trap	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Trap	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-12: Post-Accident Sampling 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
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 – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Tubing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 301
Valve body	Pressure boundary	Stainless steel	Treated water >140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water >140°F (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-13
General Service Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-13: General Service 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	A
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	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	A
Piping	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

Table 3.3.2-17-13: General Service 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**
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	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	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	A

Table 3.3.2-17-14
Reactor Building Closed Cooling Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-14: Reactor Building Closed Cooling 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	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	A
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Loss of material – wear	External Surfaces Monitoring	VII.F1.AP-113	3.3.1-82	C

Table 3.3.2-17-14: Reactor Building Closed Cooling 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**
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	A
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	A
Heat exchanger (plates)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (plates)	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	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-17-14: Reactor Building Closed Cooling 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**
Orifice	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	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	A

Table 3.3.2-17-14: Reactor Building Closed Cooling 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**
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Tank	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	C
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	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	A
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-17-14: Reactor Building Closed Cooling 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**
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	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	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A

Table 3.3.2-17-14: Reactor Building Closed Cooling 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**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	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	A

Table 3.3.2-17-15
Turbine Building Closed Cooling Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-15: Turbine Building Closed Cooling 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	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	A
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Loss of material – wear	External Surfaces Monitoring	VII.F1.AP-113	3.3.1-82	C

Table 3.3.2-17-15: Turbine Building Closed Cooling 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**
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	A
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	A
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	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	A
Heat exchanger (bonnet)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (bonnet)	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C

Table 3.3.2-17-15: Turbine Building Closed Cooling 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**
Heat exchanger (shell)	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	C
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	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	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
Sight glass	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J.AP-14	3.3.1-117	A

Table 3.3.2-17-15: Turbine Building Closed Cooling 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**
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J.AP-166	3.3.1-117	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Tank	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	C

Table 3.3.2-17-15: Turbine Building Closed Cooling 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**
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	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	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	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A

Table 3.3.2-17-15: Turbine Building Closed Cooling 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**
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	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	A

Table 3.3.2-17-16
Emergency Equipment Cooling Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-16: Emergency Equipment Cooling 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
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	--	--	H
Piping	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Piping	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

Table 3.3.2-17-16: Emergency Equipment Cooling 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**
Thermowell	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	--	–	G
Thermowell	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	A
Valve body	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2.E-29	3.2.1-44	C
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
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

Table 3.3.2-17-16: Emergency Equipment Cooling 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**
Valve body	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-17
Emergency Equipment Service Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-17: Emergency Equipment Service 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**
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Buried and Underground Piping	VII.I.AP-284	3.3.1-109.5	A
Piping	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	A
Piping	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
Sight glass	Pressure boundary	Glass	Condensation (ext)	None	None	VII.J.AP-97	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Raw water (int)	None	None	VII.J.AP-50	3.3.1-117	A

Table 3.3.2-17-17: Emergency Equipment Service 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**
Sight glass	Pressure boundary	Stainless steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	–	–	G
Sight glass	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	A
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	A
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

Table 3.3.2-17-18
Supplemental Cooling Chilled Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-18: Supplemental Cooling Chilled 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Chiller housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-189	3.3.1-46	A
Chiller housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Cooler housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C2.AP-127	3.3.1-97	C, 302
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A

Table 3.3.2-17-18: Supplemental Cooling Chilled 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
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Flex connection	Pressure boundary	Elastomer	Air – indoor (ext)	Loss of material – wear	External Surfaces Monitoring	VII.F1.AP-113	3.3.1-82	C
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	A
Flex connection	Pressure boundary	Elastomer	Treated water (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C2.AP-259	3.3.1-85	A
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	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Piping	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

Table 3.3.2-17-18: Supplemental Cooling Chilled 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	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Piping	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A

Table 3.3.2-17-18: Supplemental Cooling Chilled 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**
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Thermowell	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	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	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-202	3.3.1-45	A
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	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.C2.AP-43	3.3.1-72	A

Table 3.3.2-17-18: Supplemental Cooling Chilled 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
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-199	3.3.1-46	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	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	A

Table 3.3.2-17-19
Station Air, Control Air, Emergency Breathing Air System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-19: Station Air, Control Air, Emergency Breathing Air 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Piping	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
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-17-19: Station Air, Control Air, Emergency Breathing Air 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	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Separator	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
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Strainer housing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tank	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A

Table 3.3.2-17-19: Station Air, Control Air, Emergency Breathing Air 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**
Trap	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
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
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	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-17-19: Station Air, Control Air, Emergency Breathing Air 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	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Selective Leaching	VII.E3.AP-32	3.3.1-72	C, 305
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-20
Auxiliary Boiler System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-20: Auxiliary Boiler 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	--	--	G
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	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	--	--	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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Expansion joint	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Expansion joint	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
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	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
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	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302

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**
Piping	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
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
Pump casing	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
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	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
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Trap	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

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	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
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	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-138	3.3.1-100	C, 302
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-22
On-Line Noble Chemistry Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-22: On-Line Noble Chemistry Injection 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	C, 301
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-22: On-Line Noble Chemistry Injection 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	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-23
Fire Protection System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-23: Fire Protection 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	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	Raw water (int)	Loss of material	Fire Water System	VII.G.A-33	3.3.1-64	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-17-23: Fire Protection 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	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Fire Water System	VII.G.AP-197	3.3.1-64	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Raw water (int)	Loss of material	Selective Leaching	VII.G.A-47	3.3.1-72	A

Table 3.3.2-17-24
Zinc Injection System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-24: Zinc Injection 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Orifice	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301

Table 3.3.2-17-24: Zinc Injection 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	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
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301

Table 3.3.2-17-25
Emergency Diesel Generator System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-25: Emergency Diesel Generator 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Piping	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-127	3.3.1-97	A, 302
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Piping	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

Table 3.3.2-17-25: Emergency Diesel Generator 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	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D
Separator	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Separator	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	C
Separator	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Selective Leaching	VII.H2.A-47	3.3.1-72	A, 305
Sight glass	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VII.J.AP-135	3.3.1-113	A
Sight glass	Pressure boundary	Aluminum	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-129	3.3.1-71	A, 303
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J.AP-14	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Fuel oil (int)	None	None	VII.J.AP-49	3.3.1-117	A
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-17-25: Emergency Diesel Generator 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**
Trap	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
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	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	D
Tubing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
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	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	D
Valve body	Pressure boundary	Carbon steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-105	3.3.1-70	A, 303
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	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-17-25: Emergency Diesel Generator 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	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Fuel oil (int)	Loss of material	Diesel Fuel Monitoring	VII.H2.AP-136	3.3.1-71	A, 303

Table 3.3.2-17-26
Reactor/Auxiliary Building Systems
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-26: Reactor/Auxiliary Building Systems, 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
Piping	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
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A

Table 3.3.2-17-26: Reactor/Auxiliary Building Systems, 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**
Strainer housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
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	Lube oil (int)	Loss of material	Oil Analysis	VII.C1.AP-127	3.3.1-97	C, 302
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

Table 3.3.2-17-27
Storage Pools System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-27: Storage Pools 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-106	3.3.1-21	C, 301

**Table 3.3.2-17-28
Reactor/Auxiliary Building HVAC System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation**

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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**
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	Bolting Integrity	VII.D.AP-121	3.3.1-12	D
Bolting	Pressure boundary	Carbon steel	Condensation (ext)	Loss of preload	Bolting Integrity	–	–	H
Coil	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Coil	Pressure boundary	Copper alloy	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Coil	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-199	3.3.1-46	C
Coil	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Coil	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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**
Condenser (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.AP-41	3.3.1-80	A
Condenser (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	--	--	G
Cooler housing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Cooler housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Damper housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Damper housing	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
Duct	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Duct	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	V.B.E-25	3.2.1-44	C

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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**
Duct	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.A-08	3.3.1-90	A
Expansion joint	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Expansion joint	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Filter housing	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F2.A-08	3.3.1-90	A
Heater housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Heater housing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Humidifier	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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**
Humidifier	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	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	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	C, 308
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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	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
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Piping	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Piping	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-271	3.3.1-93	C, 308
Piping	Pressure boundary	Copper alloy	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-272	3.3.1-95	E
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Piping	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F2.AP-109	3.3.1-79	A
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.F2.AP-43	3.3.1-72	A
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-199	3.3.1-46	A
Sight glass	Pressure boundary	Glass	Condensation (ext)	None	None	VII.J.AP-97	3.3.1-117	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J.AP-166	3.3.1-117	A
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Strainer housing	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Strainer housing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	C, 308
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-272	3.3.1-95	E
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Selective Leaching	VII.F2.AP-43	3.3.1-72	A, 305
Tank	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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**
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Trap	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Tubing	Pressure boundary	Copper alloy	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F2.AP-109	3.3.1-79	A
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-199	3.3.1-46	A
Tubing	Pressure boundary	Copper alloy	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-272	3.3.1-95	E

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-81	3.3.1-78	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-270	3.3.1-88	C, 308
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
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	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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	Copper alloy > 15% Zn or > 8% Al	Condensation (ext)	Loss of material	External Surfaces Monitoring	VII.F2.AP-109	3.3.1-79	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.F2.AP-43	3.3.1-72	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-199	3.3.1-46	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-272	3.3.1-95	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Selective Leaching	VII.F2.AP-43	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
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	--	--	G

Table 3.3.2-17-28: Reactor/Auxiliary Building HVAC 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	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G

Table 3.3.2-17-29
Floor and Equipment Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-29: Floor and Equipment Drains 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

Table 3.3.2-17-30
Containment Atmospheric Control System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-30: Containment Atmospheric Control 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Orifice	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A
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	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Piping	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	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

Table 3.3.2-17-30: Containment Atmospheric Control 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	Air – indoor (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	V.D2.E-29	3.2.1-44	E
Valve body	Pressure boundary	Carbon steel	Gas (int)	None	None	VII.J.AP-6	3.3.1-121	A

Table 3.3.2-17-31
Primary Containment Pneumatics System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-31: Primary Containment Pneumatics 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	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.D.A-80	3.3.1-78	A
Piping	Pressure boundary	Carbon steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
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
Tubing	Pressure boundary	Stainless steel	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-81	3.3.1-56	B

Table 3.3.2-17-32
Primary Containment Monitoring System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-32: Primary Containment Monitoring 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Filter housing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	C
Heat exchanger (shell)	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
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-17-32: Primary Containment Monitoring 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	VII.E3.AP-110	3.3.1-25	C, 301
Piping	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Separator	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Separator	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
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
Tubing	Pressure boundary	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Tubing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-17-32: Primary Containment Monitoring 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	Stainless steel	Gas (int)	None	None	VII.J.AP-22	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VII.E3.AP-110	3.3.1-25	C, 301
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-33
Turbine Building HVAC System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-33: Turbine Building HVAC 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Coil	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	C
Coil	Pressure boundary	Copper alloy	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Coil	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F3.AP-203	3.3.1-46	A
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H

Table 3.3.2-17-33: Turbine Building HVAC 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**
Flow element	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
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	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G

Table 3.3.2-17-33: Turbine Building HVAC 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	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	--	–	H
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Piping	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
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A

Table 3.3.2-17-33: Turbine Building HVAC 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**
Thermowell	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	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
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	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H

Table 3.3.2-17-33: Turbine Building HVAC 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	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-202	3.3.1-45	A
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	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VII.F2.AP-43	3.3.1-72	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.F2.AP-199	3.3.1-46	A
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J.AP-123	3.3.1-120	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	–	–	G

Table 3.3.2-17-33: Turbine Building HVAC 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	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	G
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	–	–	G
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – Closed Treated Water Systems	VII.C2.AP-186	3.3.1-43	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – Closed Treated Water Systems	VII.C2.A-52	3.3.1-49	C
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.3.2-17-34
Turbine Building Potable Water and Plumbing System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-34: Turbine Building Potable Water and Plumbing 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
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	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.A-77	3.3.1-78	A
Pump casing	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	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

Table 3.3.2-17-34: Turbine Building Potable Water and Plumbing 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	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-272	3.3.1-95	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Waste water (int)	Loss of material	Selective Leaching	VII.E5.A-407	3.3.1-72	A

Table 3.3.2-17-35
RHR Complex and Office Service Building HVAC System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.3.2-17-35: RHR Complex and Office Service Building HVAC 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VII.I.AP-125	3.3.1-12	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VII.I.AP-124	3.3.1-15	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
Piping	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	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VII.F2.A-10	3.3.1-78	A
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

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 3.3.2-17-36: RHR Complex Drains and OSB 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	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	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-281	3.3.1-91	A

3.4 STEAM AND POWER CONVERSION SYSTEMS

3.4.1 Introduction

This section provides the results of the aging management reviews for components in the steam and power conversion systems that are subject to aging management review. The following systems are addressed in this section (the system descriptions are available in the referenced section).

- Condensate Storage and Transfer (Section 2.3.4.1)
- Feedwater and Standby Feedwater (Section 2.3.4.2)
- Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) (Section 2.3.4.3)

Table 3.4.1, Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the steam and power conversion system component group. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.4.2 Results

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

- Table 3.4.2-1 Condensate Storage and Transfer System—Summary of Aging Management Evaluation

- Table 3.4.2-2 Feedwater and Standby Feedwater System—Summary of Aging Management Evaluation

Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

- Table 3.4.2-3-1 Main Steam System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-2 Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-3 Feedwater and Standby Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-4 Heater Drains System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-5 Main Turbine Generator and Auxiliaries System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-6 Condenser and Auxiliaries System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-7 Circulating Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-8 Condensate Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-3-9 Drips, Drains and Vents System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

3.4.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the steam and power conversion systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.4.2.1.1 Condensate Storage and Transfer System

Materials

Condensate storage and transfer system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Stainless steel

Environments

Condensate storage and transfer system components are exposed to the following environments.

- Air – indoor
- Air – outdoor

- Concrete
- Soil
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the condensate storage and transfer system require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the condensate storage and transfer system components.

- Aboveground Metallic Tanks
- Bolting Integrity
- Buried and Underground Piping
- External Surfaces Monitoring
- One-Time Inspection
- Water Chemistry Control – BWR

3.4.2.1.2 Feedwater and Standby Feedwater System

Materials

Feedwater and standby feedwater system components are constructed of the following materials.

- Carbon steel
- Copper alloy > 15% zinc (inhibited)
- Glass
- Stainless steel

Environments

Feedwater and standby feedwater system components are exposed to the following environments.

- Air – indoor

- Air – outdoor
- Lube oil
- Soil
- Steam
- Treated water
- Treated water > 140°F

Aging Effects Requiring Management

The following aging effects associated with the feedwater and standby feedwater system require management.

- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the feedwater and standby feedwater system components.

- Bolting Integrity
- Buried and Underground Piping
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – BWR

3.4.2.1.3 <u>Miscellaneous Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)</u>

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.4.2-3-xx tables.

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

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

- Nickel alloy
- Plastic
- Stainless steel

Environments

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Lube oil
- Raw water
- Steam
- Treated water
- Treated water > 140°F
- Waste water

Aging Effects Requiring Management

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of material
- Loss of material – wear
- Loss of preload

Aging Management Programs

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – BWR

3.4.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.4.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.4.2.2.1 Cumulative Fatigue Damage

Where fatigue is identified as an aging effect requiring management, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluation of this TLAA is addressed in Section 4.3.

3.4.2.2.2 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. At Fermi 2, there are no stainless steel steam and power conversion systems components included within the scope of license renewal that are located indoors near unducted air intakes.

3.4.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, loss of material of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. At Fermi 2, there are no steam and power conversion systems included in the scope of license renewal that are located indoors near unducted air intakes.

3.4.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of Fermi 2 quality assurance procedures and administrative controls for aging management programs.

3.4.2.2.5 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of the Fermi 2 operating experience review programs.

3.4.2.2.6 Loss of Material due to Recurring Internal Corrosion

Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on recurring internal corrosion in the development of the license renewal application.

3.4.2.3 Time-Limited Aging Analysis

The only time-limited aging analysis identified for the steam and power conversion systems components is metal fatigue. This is evaluated in Section 4.3.

3.4.3 Conclusion

The steam and power conversion system components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on steam and power conversion system components are identified in Section 3.4.2.1 and in the following tables. A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the steam and power conversion system components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.4.1
Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-1	Steel piping, piping components, and piping elements exposed to steam or treated water	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	Fatigue is a TLAA. See Section 3.4.2.2.1.
3.4.1-2	Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated	Consistent with NUREG-1801. Cracking of stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program. See Section 3.4.2.2.2.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-3	Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes, environmental conditions need to be evaluated	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program. See Section 3.4.2.2.3.
3.4.1-4	PWR only				
3.4.1-5	Steel piping, piping components, and piping elements exposed to steam, treated water	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, “Flow-Accelerated Corrosion”	No	Consistent with NUREG-1801. Loss of material due to flow-accelerated corrosion in steel components exposed to steam or treated water is managed by the Flow-Accelerated Corrosion Program.
3.4.1-6	Steel, stainless steel bolting exposed to soil	Loss of preload	Chapter XI.M18, "Bolting Integrity"	No	This item was not used. There is no steel or stainless steel bolting exposed to soil in the steam and power conversion systems in the scope of license renewal.
3.4.1-7	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	This item was not used. There is no high strength steel bolting in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-8	Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor, uncontrolled (external)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of material for steel and stainless steel closure bolting exposed to indoor and outdoor air is managed by the Bolting Integrity Program.
3.4.1-9	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	This item was not used. As stated in Item 3.4.1-8, loss of material of steel bolting exposed to air in the steam and power conversion systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment.
3.4.1-10	Copper alloy, nickel alloy, steel; stainless steel, steel; stainless steel bolting, closure bolting exposed to any environment, air – outdoor (external), air – indoor, uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Consistent with NUREG-1801. Loss of preload for steel and stainless steel bolting is managed by the Bolting Integrity Program. Copper alloy and nickel alloy bolting is not included in the scope of license renewal for steam and power conversion systems.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-11	Stainless steel piping, piping components, and piping elements, tanks, heat exchanger components exposed to steam, treated water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Cracking of stainless steel components exposed to steam or treated water > 60°C (> 140°F) is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage cracking.
3.4.1-12	Steel; stainless steel tanks exposed to treated water	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel or stainless steel tanks exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.
3.4.1-13	PWR only				

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-14	Steel piping, piping components, and piping elements, PWR heat exchanger components exposed to steam, treated water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to steam or treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.
3.4.1-15	Steel heat exchanger components exposed to treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for steel heat exchanger components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-16	Copper alloy, stainless steel, nickel alloy, aluminum piping, piping components, and piping elements, heat exchanger components and tubes, PWR heat exchanger components exposed to treated water, steam	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for aluminum, copper alloy and stainless steel components exposed to steam or treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. There are no nickel alloy components exposed to treated water in the steam and power conversion systems in the scope of license renewal.
3.4.1-17	PWR only				

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-18	Copper alloy, stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Fouling of copper alloy heat exchanger tubes exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage fouling. There are no stainless steel heat exchanger tubes exposed to treated water in the steam and power conversion systems with a license renewal intended function of heat transfer.
3.4.1-19	Stainless steel, steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no heat exchanger components exposed to raw water in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-20	Copper alloy, stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no piping components exposed to raw water (open cycle cooling water) in the steam and power conversion systems in the scope of license renewal.
3.4.1-21	PWR only				
3.4.1-22	Stainless steel, copper alloy, steel heat exchanger tubes, heat exchanger components exposed to raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. There are no heat exchanger tubes exposed to raw water with an intended function of heat transfer in the steam and power conversion systems in the scope of license renewal.
3.4.1-23	Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (> 140°F)	Cracking due to stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no stainless steel components exposed to closed-cycle cooling water > 60°C (> 140°F) in the steam and power conversion systems in the scope of license renewal.
3.4.1-24	Steel heat exchanger components exposed to closed-cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no steel heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-25	Steel heat exchanger components exposed to closed-cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no steel heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.
3.4.1-26	Stainless steel heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no stainless steel components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.
3.4.1-27	Copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no copper alloy components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal.
3.4.1-28	Steel, stainless steel, copper alloy heat exchanger components and tubes, heat exchanger tubes exposed to closed-cycle cooling water	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	This item was not used. There are no heat exchanger tubes exposed to closed-cycle cooling water with an intended function of heat transfer in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-29	Steel tanks exposed to air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	This item was not used. There are no steel tanks exposed to outdoor air in the steam and power conversion systems in the scope of license renewal.
3.4.1-30	Steel, stainless steel, aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to general (steel only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M29, "Aboveground Metallic Tanks"	No	This item was not used. There are no steel or stainless steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the steam and power conversion systems. Aluminum tanks are addressed in Item 3.4.1-31.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-31	Stainless steel, aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation	Loss of material due to pitting, and crevice corrosion; cracking due to stress corrosion cracking	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Consistent with NUREG-1801. Loss of material and cracking for aluminum tanks exposed to outdoor air, concrete or soil is managed by the Aboveground Metallic Tanks Program. There are no stainless steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the steam and power conversion systems.
3.4.1-32	Gray cast iron piping, piping components, and piping elements exposed to soil	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	This item was not used. There are no gray cast iron components exposed to soil in the steam and power conversion systems in the scope of license renewal.
3.4.1-33	Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements exposed to treated water, raw water, closed-cycle cooling water	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Consistent with NUREG-1801. Loss of material for copper alloy (> 15% Zn or > 8% Al) components exposed to treated water is managed by the Selective Leaching Program. There are no gray cast iron components exposed to water environments in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-34	Steel external surfaces exposed to air – indoor, uncontrolled (external), air – outdoor (external), condensation (external)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to indoor or outdoor air is managed by the External Surfaces Monitoring Program. There are no steel components exposed to condensation in the steam and power conversion systems in the scope of license renewal.
3.4.1-35	Aluminum piping, piping components, and piping elements exposed to air - outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Loss of material for aluminum piping components exposed to outdoor air is managed by the Buried and Underground Piping Program.
3.4.1-36	PWR only				
3.4.1-37	PWR only				
3.4.1-38	PWR only				
3.4.1-39	Stainless steel piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	This item was not used. There are no stainless steel components exposed to condensation in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-40	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801 for most components. Loss of material for steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.
3.4.1-41	PWR only				
3.4.1-42	PWR only				
3.4.1-43	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for copper alloy components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.
3.4.1-44	Stainless steel piping, piping components, and piping elements, heat exchanger components exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-45	PWR only				
3.4.1-46	PWR only				
3.4.1-47	Steel (with coating or wrapping), stainless steel, nickel-alloy piping, piping components, and piping elements; tanks exposed to soil or concrete	Loss of material due to general (steel only), pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. Loss of material for steel or stainless steel components exposed to soil or concrete is managed by the Buried and Underground Piping Program. There are no nickel alloy components exposed to soil or concrete in the steam and power conversion systems in the scope of license renewal.
3.4.1-48	Stainless steel, nickel-alloy bolting exposed to soil	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There is no stainless steel or nickel alloy bolting exposed to soil in the steam and power conversion systems in the scope of license renewal.
3.4.1-49	Stainless steel, nickel-alloy piping, piping components, and piping elements exposed to soil or concrete	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Consistent with NUREG-1801. Loss of material for stainless steel components exposed to soil is managed by the Buried and Underground Piping Program. There are no nickel alloy components exposed to soil or concrete in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-50	Steel bolting exposed to soil	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There is no steel bolting exposed to soil in the steam and power conversion systems in the scope of license renewal.
3.4.1-50.5	Underground stainless steel, nickel-alloy and steel piping, piping components, and piping elements	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	This item was not used. There is no underground piping in areas of restricted access in the steam and power conversion systems in the scope of license renewal.
3.4.1-51	Steel piping, piping components, and piping elements exposed to concrete	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	This item was not used. There are no steel components embedded in concrete in the steam and power conversion systems in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-52	Aluminum piping, piping components, and piping elements exposed to gas, air – indoor, uncontrolled (internal/external)	None	None	NA – No AEM or AMP	Consistent with NUREG-1801 for aluminum components exposed to air. There are no aluminum components exposed to gas in the steam and power conversion systems in the scope of license renewal.
3.4.1-53	PWR only				
3.4.1-54	Copper alloy piping, piping components, and piping elements exposed to gas, air – indoor, uncontrolled (external)	None	None	NA – No AEM or AMP	Consistent with NUREG-1801 for copper alloy components exposed to air. There are no copper alloy components exposed to gas in the steam and power conversion systems in the scope of license renewal.
3.4.1-55	Glass piping elements exposed to lubricating oil, air – outdoor, condensation (internal/external), raw water, treated water, air with borated water leakage, gas, closed-cycle cooling water, air – indoor, uncontrolled (external)	None	None	NA – No AEM or AMP	Consistent with NUREG-1801 for glass components exposed to indoor air, lube oil and treated water. There are no glass steam and power conversion system components exposed to other environments represented by this item in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-56	Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external)	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.
3.4.1-57	Nickel alloy, PVC piping, piping components, and piping elements exposed to air with borated water leakage, air – indoor, uncontrolled, condensation (internal)	None	None	NA – No AEM or AMP	This item was not used. There are no nickel alloy or PVC components exposed to the environments represented by this item in the steam and power conversion systems in the scope of license renewal.
3.4.1-58	Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), concrete, gas, air – indoor, uncontrolled (internal)	None	None	NA – No AEM or AMP	Consistent with NUREG-1801 for stainless steel components exposed to air. There are no stainless steel steam and power conversion system components exposed to other environments represented by this item in the scope of license renewal.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-59	Steel piping, piping components, and piping elements exposed to air – indoor controlled (external), gas	None	None	NA – No AEM or AMP	This item was not used. There are no steel steam and power conversion system components exposed to the environments represented by this item in the scope of license renewal.
3.4.1-60	Any material, piping, piping components, and piping elements exposed to treated water	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Consistent with NUREG-1801. Loss of material due to erosion is managed by the Flow-Accelerated Corrosion Program for components exposed to treated water.
3.4.1-61	Metallic piping, piping components, and tanks exposed to raw water or waste water	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion.	Yes, plant-specific	Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on recurring internal corrosion in the development of the license renewal application. (See Section 3.4.2.2.6.)

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-62	Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Consistent with NUREG-1801. Loss of material for aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water is managed by the Aboveground Metallic Tanks Program. There are no steel or stainless steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the steam and power conversion systems.
3.4.1-63	Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor	Loss of material due to general (steel, and copper alloy), pitting, or crevice corrosion, and cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only)	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only)	No	Due to the timing of the issuance of LR-ISG-2012-02, it was not feasible to include guidance on corrosion under insulation in the development of the license renewal application.

Table 3.4.1: Steam and Power Conversion Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-64	Jacketed calcium silicate or fiberglass insulation in an air-indoor uncontrolled or air-outdoor environment	Reduced thermal insulation resistance due to moisture intrusion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no insulation components with an intended function of thermal insulation in the steam and power conversion systems.
3.4.1-65	Jacketed foamglas ® (glass dust) insulation in an air-indoor uncontrolled or air-outdoor environment	Reduced thermal insulation resistance due to moisture intrusion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	This item was not used. There are no insulation components with an intended function of thermal insulation in the steam and power conversion systems.

Notes for Tables 3.4.2-1 through 3.4.2-3-9

Generic Notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

401. The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

402. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

403. The steam environment for this component type is produced from and is equivalent to treated water for the purposes of evaluating loss of material due to erosion.

Table 3.4.2-1
Condensate Storage and Transfer System
Summary of Aging Management Evaluation

Table 3.4.2-1: Condensate Storage and Transfer System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-82	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-151	3.4.1-10	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-82	3.4.1-8	B
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-151	3.4.1-10	B
Flex connection	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	Buried and Underground Piping	–	–	G
Flex connection	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking – fatigue	TLAA – metal fatigue	–	–	G

Table 3.4.2-1: Condensate Storage and Transfer System

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 – outdoor (ext)	Loss of material	Buried and Underground Piping	–	–	G
Flex connection	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Flow element	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flow element	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Piping	Pressure boundary	Aluminum	Air – outdoor (ext)	Cracking	Buried and Underground Piping	–	–	H
Piping	Pressure boundary	Aluminum	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	VIII.H.SP-147	3.4.1-35	E

Table 3.4.2-1: Condensate Storage and Transfer System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-90	3.4.1-16	A, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	--	--	G
Piping	Pressure boundary	Carbon steel	Concrete (ext)	Loss of material	Buried and Underground Piping	VIII.E.SP-145	3.4.1-47	A
Piping	Pressure boundary	Carbon steel	Soil (ext)	Loss of material	Buried and Underground Piping	VIII.E.SP-145	3.4.1-47	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Piping	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	Buried and Underground Piping	–	–	G
Piping	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	–	–	G
Piping	Pressure boundary	Stainless steel	Soil (ext)	Cracking	Buried and Underground Piping	–	–	H
Piping	Pressure boundary	Stainless steel	Soil (ext)	Loss of material	Buried and Underground Piping	VIII.E.SP-94	3.4.1-49	A

Table 3.4.2-1: Condensate Storage and Transfer System								
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	VIII.E.SP-87	3.4.1-16	A, 401
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Tank	Pressure boundary	Aluminum	Air – outdoor (ext)	Cracking	Aboveground Metallic Tanks	VIII.E.SP-139	3.4.1-31	A
Tank	Pressure boundary	Aluminum	Air – outdoor (ext)	Loss of material	Aboveground Metallic Tanks	VIII.E.SP-139	3.4.1-31	A
Tank	Pressure boundary	Aluminum	Concrete (ext)	Loss of material	Aboveground Metallic Tanks	VIII.E.SP-139	3.4.1-31	A
Tank	Pressure boundary	Aluminum	Soil (ext)	Loss of material	Aboveground Metallic Tanks	VIII.E.SP-139	3.4.1-31	A
Tank	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Aboveground Metallic Tanks	VIII.E.S-405	3.4.1-62	A
Tank	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-90	3.4.1-16	C, 401
Thermowell	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	VIII.E.SP-118	3.4.1-2	A
Thermowell	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VIII.E.SP-127	3.4.1-3	A

Table 3.4.2-1: Condensate Storage and Transfer System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A
Tubing	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	C
Tubing	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Tubing	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	External Surfaces Monitoring	VIII.E.SP-118	3.4.1-2	A
Tubing	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VIII.E.SP-127	3.4.1-3	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	--	--	G
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-41	3.4.1-34	A

Table 3.4.2-1: Condensate Storage and Transfer System								
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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Valve body	Pressure boundary	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	C
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Air – outdoor (ext)	Cracking	Buried and Underground Piping	–	–	G
Valve body	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	–	–	G
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401

Table 3.4.2-2
Feedwater and Standby Feedwater System
Summary of Aging Management Evaluation

Table 3.4.2-2: Feedwater and Standby Feedwater System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-82	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-151	3.4.1-10	B
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-82	3.4.1-8	B
Bolting	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-151	3.4.1-10	B
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402

Table 3.4.2-2: Feedwater and Standby Feedwater System

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 – outdoor (ext)	Cracking	Buried and Underground Piping	–	–	G
Flex connection	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	–	–	G
Flex connection	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Heat exchanger (end channel)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	C, 401

Table 3.4.2-2: Feedwater and Standby Feedwater System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (end channel)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	C
Heat exchanger (end channel)	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	C, 401
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	C, 402
Heat exchanger (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Heat exchanger (tube sheet)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Heat exchanger (tube sheet)	Pressure boundary	Carbon steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	C, 401
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-95	3.4.1-44	C, 402

Table 3.4.2-2: Feedwater and Standby Feedwater System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tube sheet)	Pressure boundary	Stainless steel	Treated water (ext)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	C, 401
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Fouling	Oil Analysis	V.D2.EP-78	3.2.1-51	C, 402
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Lube oil (ext)	Loss of material	Oil Analysis	VIII.D2.SP-92	3.4.1-43	C, 402
Heat exchanger (tubes)	Heat transfer	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Fouling	Water Chemistry Control – BWR	VIII.E.SP-100	3.4.1-18	C, 401
Heat exchanger (tubes)	Pressure boundary	Copper alloy > 15% zinc (inhibited)	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Steam (ext)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 401
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Steam (ext)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	C, 401
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 401

Table 3.4.2-2: Feedwater and Standby Feedwater System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	C, 401
Orifice	Pressure boundary Flow control	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary Flow control	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	–	–	G
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.D2.S-11	3.4.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401

Table 3.4.2-2: Feedwater and Standby Feedwater System								
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	Air – outdoor (ext)	Cracking	Buried and Underground Piping	–	–	G
Piping	Pressure boundary	Stainless steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	–	–	G
Piping	Pressure boundary	Stainless steel	Soil (ext)	Cracking	Buried and Underground Piping	–	–	H
Piping	Pressure boundary	Stainless steel	Soil (ext)	Loss of material	Buried and Underground Piping	VIII.G.SP-145	3.4.1-47	A
Piping	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	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	A, 401
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402

Table 3.4.2-2: Feedwater and Standby Feedwater System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I.SP-9	3.4.1-55	A
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	VIII.I.SP-10	3.4.1-55	A
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	C
Tank	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-95	3.4.1-44	C, 402
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Thermowell	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-95	3.4.1-44	A, 402
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 401
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Tubing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401

Table 3.4.2-2: Feedwater and Standby Feedwater System								
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	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.C.SP-88	3.4.1-11	C, 401
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	Buried and Underground Piping	–	–	G
Valve body	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-41	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.D2.S-11	3.4.1-1	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A

Table 3.4.2-2: Feedwater and Standby Feedwater System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-95	3.4.1-44	A, 402
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401

Table 3.4.2-3-1
Main Steam System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-1: Main Steam 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Coil	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	C
Coil	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Coil	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flex connection	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	A, 401
Flex connection	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	A, 401
Flow element	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-1: Main Steam 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**
Flow element	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	A
Flow element	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	A, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	A, 401
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	A, 401
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	A, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	A

Table 3.4.2-3-1: Main Steam 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	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	A, 401

Table 3.4.2-3-2
Condensate System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-2: Condensate 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Chamber	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Chamber	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Cooler housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-77	3.4.1-15	A, 401
Expansion joint	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Expansion joint	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Expansion joint	Pressure boundary	Elastomer	Air – indoor (ext)	Loss of material – wear	External Surfaces Monitoring	VII.F1.AP-113	3.3.1-82	C

Table 3.4.2-3-2: Condensate 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**
Expansion joint	Pressure boundary	Elastomer	Treated water (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.A4.AP-101	3.3.1-86	C
Expansion joint	Pressure boundary	Elastomer	Treated water (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.A4.AP-101	3.3.1-86	C
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Filter housing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flow element	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	A, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401

Table 3.4.2-3-2: Condensate 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**
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-77	3.4.1-15	A, 401
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	A, 401
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-2: Condensate 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	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.E.SP-91	3.4.1-40	A, 402
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15 VIII.D2.S-408	3.4.1-5 3.4.1-60	C C, 403
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E.S-16 VIII.D2.S-408	3.4.1-5 3.4.1-60	A C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Piping	Pressure boundary	Carbon steel	Waster water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.E.SP-91	3.4.1-40	A, 402

Table 3.4.2-3-2: Condensate 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	VIII.E.SP-73	3.4.1-14	A, 401
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Pump casing	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Pump casing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	A, 401
Pump casing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Pump casing	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-278	3.3.1-95	E
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.E.SP-91	3.4.1-40	A, 402
Sight glass	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I.SP-9	3.4.1-55	A

Table 3.4.2-3-2: Condensate 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**
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	VIII.I.SP-10	3.4.1-55	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VIII.I.SP-35	3.4.1-55	A
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	A, 401
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-75	3.4.1-12	A, 401
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	C
Tank	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-278	3.3.1-95	E

Table 3.4.2-3-2: Condensate 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**
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Thermowell	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	A, 401
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.E.SP-91	3.4.1-40	A, 402
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.E.S-16 VIII.D2.S-408	3.4.1-5 3.4.1-60	A C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A

Table 3.4.2-3-2: Condensate 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	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	A, 401
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-278	3.3.1-95	E

Table 3.4.2-3-3
Feedwater and Standby Feedwater System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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**
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Accumulator	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402
Accumulator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Eliminator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Eliminator	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
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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**
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402
Filter housing	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
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flow element	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Flow element	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Flow element	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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**
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	C, 402
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	C, 401
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15 VIII.D2.S-408	3.4.1-5 3.4.1-60	C A, 403

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.D2.S-11	3.4.1-1	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16 VIII.D2.S-408	3.4.1-5 3.4.1-60	A A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401
Piping	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
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401
Pump casing	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
Rupture disc	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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
Rupture disc	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Rupture disc	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Sight glass	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
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I.SP-9	3.4.1-55	A
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	VIII.I.SP-10	3.4.1-55	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VIII.I.SP-35	3.4.1-55	A
Sight glass	Pressure boundary	Glass	Waste water (int)	None	None	VII.J.AP-277	3.3.1-119	C
Sight glass	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Sight glass	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-95	3.4.1-44	A, 402

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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**
Sight glass	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Sight glass	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Sight glass	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.D2.S-11	3.4.1-1	A
Strainer housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	C, 402
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	C, 401
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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**
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401
Turbine housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Turbine housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-91	3.4.1-40	A, 402
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15 VIII.D2.S-408	3.4.1-5 3.4.1-60	C A, 403
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 401
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.D2.S-11	3.4.1-1	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16	3.4.1-5	A

Table 3.4.2-3-3: Feedwater and Standby Feedwater 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	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-73	3.4.1-14	A, 401
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.D2.SP-95	3.4.1-44	A, 402
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-87	3.4.1-16	A, 401

Table 3.4.2-3-4
Heater Drains System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-4: Heater Drains 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401

Table 3.4.2-3-4: Heater Drains 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**
Orifice	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A
Orifice	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	C
Orifice	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C

Table 3.4.2-3-4: Heater Drains 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	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16 VIII.D2.S-408	3.4.1-5 3.4.1-60	C C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-408	3.4.1-60	C
Piping	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401

Table 3.4.2-3-4: Heater Drains 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**
Strainer housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Strainer housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-75	3.4.1-12	C, 401
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401

Table 3.4.2-3-4: Heater Drains 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
Thermowell	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-278	3.3.1-95	E
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Tubing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-16 VIII.D2.S-408	3.4.1-5 3.4.1-60	C C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401

Table 3.4.2-3-4: Heater Drains 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	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401

Table 3.4.2-3-5
Main Turbine Generator and Auxiliaries System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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
Accumulator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Accumulator	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402
Accumulator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Condenser (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Condenser (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Cooler housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	C, 402

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Cooler housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	C
Cooler housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	C
Cooler housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Cooler housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	C
Cooler housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Cooler housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Cylinder	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Cylinder	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	A, 401
Dryer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Dryer	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Eliminator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Eliminator	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
Expansion joint	Pressure boundary	Elastomer	Air – indoor (ext)	Change in material properties	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Expansion joint	Pressure boundary	Elastomer	Air – indoor (ext)	Cracking	External Surfaces Monitoring	VII.F1.AP-102	3.3.1-76	C
Expansion joint	Pressure boundary	Elastomer	Air – indoor (ext)	Loss of material – wear	External Surfaces Monitoring	VII.F1.AP-113	3.3.1-82	C
Expansion joint	Pressure boundary	Elastomer	Steam (int)	Change in material properties	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Expansion joint	Pressure boundary	Elastomer	Steam (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Expansion joint	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	VIII.I.SP-11	3.4.1-56	A
Expansion joint	Pressure boundary	Nickel alloy	Steam (int)	Cracking	Water Chemistry Control – BWR	--	--	G
Expansion joint	Pressure boundary	Nickel alloy	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	G
Expansion joint	Pressure boundary	Nickel alloy	Steam (int)	Loss of material	Water Chemistry Control – BWR	--	--	G
Expansion joint	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401
Fan housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Fan housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402
Fan housing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	A, 401

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Fan housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402
Filter housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A
Filter housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	C
Filter housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	A, 401
Filter housing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Filter housing	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Flex connection	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Flex connection	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Flow element	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flow element	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	A, 401
Flow element	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Flow element	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	A, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Flow element	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-77	3.4.1-15	C, 401
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	C, 402
Orifice	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Orifice	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Orifice	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-95	3.4.1-44	A, 402
Orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	A, 401
Orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Orifice	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	A, 401
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Orifice	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15 VIII.D2.S-408	3.4.1-5 3.4.1-60	A C, 403
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	A, 401

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Piping	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
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Piping	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	A, 401
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-408	3.4.1-60	C, 403
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	A, 401
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Rupture disc	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Rupture disc	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	A, 401
Rupture disc	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	A, 401
Separator	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Separator	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Sight glass	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Sight glass	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Sight glass	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-92	3.4.1-43	A, 402
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VIII.I.SP-9	3.4.1-55	A
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	VIII.I.SP-10	3.4.1-55	A
Strainer housing	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VIII.I.SP-93	3.4.1-52	A
Strainer housing	Pressure boundary	Aluminum	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.D2.SP-90	3.4.1-16	A, 401
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Strainer housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	C
Strainer housing	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	A, 401

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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**
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	C, 402
Tank	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	A, 401
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-75	3.4.1-12	C, 401
Tank	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
Tank	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Thermowell	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Thermowell	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-95	3.4.1-44	A, 402
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	A, 401
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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
Thermowell	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	A, 401
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Thermowell	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Trap	Pressure boundary	Aluminum	Air – indoor (ext)	None	None	VIII.I.SP-93	3.4.1-52	A
Trap	Pressure boundary	Aluminum	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	–	–	G
Turbine housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Turbine housing	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	A, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	A, 402

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	A, 401
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
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	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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	Copper alloy > 15% Zn or > 8% Al	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-92	3.4.1-43	A, 402
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	A, 401
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-95	3.4.1-44	A, 402
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	A, 401
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	A, 401

Table 3.4.2-3-5: Main Turbine Generator and Auxiliaries 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	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C
Valve body	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.E5.AP-278	3.3.1-95	C

Table 3.4.2-3-6
Condenser and Auxiliaries System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-6: Condenser and Auxiliaries 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
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Condenser (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Condenser (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Condenser (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-77	3.4.1-15	C, 401
Cooler housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Cooler housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	C, 402
Cooler housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-77	3.4.1-15	C, 401
Ejector	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A

Table 3.4.2-3-6: Condenser and Auxiliaries 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**
Ejector	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Expansion joint	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Expansion joint	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Expansion joint	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Expansion joint	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Expansion joint	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.A.SP-98	3.4.1-11	C, 401
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Expansion joint	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-155	3.4.1-16	C, 401
Expansion joint	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Water Chemistry Control – BWR	VIII.E.SP-88	3.4.1-11	C, 401
Expansion joint	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking – fatigue	TLAA – metal fatigue	VII.E3.A-62	3.3.1-2	C

Table 3.4.2-3-6: Condenser and Auxiliaries 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**
Expansion joint	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	C, 401
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Filter housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	C, 402
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A

Table 3.4.2-3-6: Condenser and Auxiliaries 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	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	C, 402
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Trap	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil Analysis	VIII.A.SP-91	3.4.1-40	C, 402
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	C, 401

Table 3.4.2-3-6: Condenser and Auxiliaries 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	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	C
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401

Table 3.4.2-3-7
Circulating Water System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-7: Circulating 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flex connection	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C
Piping	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Piping	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

Table 3.4.2-3-7: Circulating 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	Raw water (int)	None	None	–	–	F
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Pump casing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
Pump casing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Pump casing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C
Strainer housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Strainer housing	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C

Table 3.4.2-3-7: Circulating 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**
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Tubing	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-408	3.3.1-134	C
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	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Raw water (int)	Loss of material	Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1.A-409	3.3.1-134	C

Table 3.4.2-3-8
Condensate Storage and Transfer System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-8: Condensate Storage and Transfer 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Flex connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Flex connection	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401

Table 3.4.2-3-8: Condensate Storage and Transfer 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	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Tank	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	C
Tank	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-75	3.4.1-12	A, 401
Trap	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Trap	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Trap	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401

Table 3.4.2-3-8: Condensate Storage and Transfer 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	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Valve body	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-71	3.4.1-14	C, 401
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-73	3.4.1-14	A, 401
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Air – indoor (ext)	None	None	VIII.I.SP-6	3.4.1-54	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Selective Leaching	VIII.E.SP-55	3.4.1-33	A
Valve body	Pressure boundary	Copper alloy > 15% Zn or > 8% Al	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.A.SP-101	3.4.1-16	C, 401
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Water Chemistry Control – BWR	VIII.E.SP-87	3.4.1-16	A, 401

Table 3.4.2-3-9
Drips, Drains and Vents System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation

Table 3.4.2-3-9: Drips, Drains and Vents 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**
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting Integrity	VIII.H.SP-84	3.4.1-8	B
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of preload	Bolting Integrity	VIII.H.SP-83	3.4.1-10	B
Condenser (shell)	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	C
Condenser (shell)	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Condenser (shell)	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401
Orifice	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Orifice	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Orifice	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401

Table 3.4.2-3-9: Drips, Drains and Vents 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	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Piping	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.A.S-15 VIII.D2.S-408	3.4.1-5 3.4.1-60	A C, 403
Piping	Pressure boundary	Carbon steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 401
Piping	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Piping	Pressure boundary	Nickel alloy	Air – indoor (ext)	None	None	VIII.I.SP-11	3.4.1-56	A
Piping	Pressure boundary	Nickel alloy	Steam (int)	Cracking	Water Chemistry Control – BWR	–	–	G
Piping	Pressure boundary	Nickel alloy	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	G
Piping	Pressure boundary	Nickel alloy	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-408	3.4.1-60	C, 403
Piping	Pressure boundary	Nickel alloy	Steam (int)	Loss of material	Water Chemistry Control – BWR	–	–	G

Table 3.4.2-3-9: Drips, Drains and Vents 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	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Piping	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Flow-Accelerated Corrosion	VIII.D2.S-408	3.4.1-60	C, 403
Piping	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Tubing	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Tubing	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External Surfaces Monitoring	VIII.H.S-29	3.4.1-34	A
Valve body	Pressure boundary	Carbon steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	VIII.B2.S-08	3.4.1-1	C

Table 3.4.2-3-9: Drips, Drains and Vents 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	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-160	3.4.1-14	C, 401
Valve body	Pressure boundary	Carbon steel	Waste water (int)	Loss of material	Periodic Surveillance and Preventive Maintenance	VII.E5.AP-281	3.3.1-91	E
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VIII.I.SP-12	3.4.1-58	A
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking	Water Chemistry Control – BWR	VIII.B2.SP-98	3.4.1-11	C, 401
Valve body	Pressure boundary	Stainless steel	Steam (int)	Cracking – fatigue	TLAA – metal fatigue	–	–	H
Valve body	Pressure boundary	Stainless steel	Steam (int)	Loss of material	Water Chemistry Control – BWR	VIII.B2.SP-155	3.4.1-16	C, 401

3.5 CONTAINMENTS, STRUCTURES AND COMPONENT SUPPORTS

3.5.1 Introduction

This section provides the results of the aging management review for structural components and commodities that are subject to aging management review. The following structures and commodity groups are addressed in this section (descriptions are available in the referenced sections).

- Reactor/Auxiliary Building and Primary Containment (Section 2.4.1)
- Water-Control Structures (Section 2.4.2)
- Turbine Building, Process Facilities, and Yard Structures (Section 2.4.3)
- Bulk Commodities (Section 2.4.4)

Table 3.5.1, Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for structures and component supports. Hyperlinks are provided to the program evaluations in Appendix B.

3.5.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for structures and component supports.

- Table 3.5.2-1 Reactor/Auxiliary Building and Primary Containment—Summary of Aging Management Evaluation
- Table 3.5.2-2 Water-Control Structures—Summary of Aging Management Evaluation
- Table 3.5.2-3 Turbine Building, Process Facilities, and Yard Structures—Summary of Aging Management Evaluation
- Table 3.5.2-4 Bulk Commodities—Summary of Aging Management Evaluation

3.5.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for structures and component supports subject to aging management review. Programs are described in Appendix B. Further details are provided in the structure and commodities tables.

3.5.2.1.1 Reactor/Auxiliary Building and Primary Containment

Materials

Reactor/auxiliary building and primary containment components are constructed of the following materials.

- Aluminum
- Carbon steel
- Coatings
- Concrete
- Concrete block
- Elastomer
- Galvanized steel
- Stainless steel

Environments

Reactor/auxiliary building and primary containment components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Concrete
- Exposed to fluid environment
- Soil

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

Aging Management Programs

The following programs are credited for managing the effects of aging on reactor/ auxiliary building and primary containment components.

- Containment Inservice Inspection – IWE
- Containment Leak Rate
- Fire Protection
- Inservice Inspection – IWF
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Masonry Wall
- Periodic Surveillance and Preventive Maintenance
- Protective Coating Monitoring and Maintenance
- Structures Monitoring
- Water Chemistry Control – BWR

3.5.2.1.2 Water-Control Structures

Materials

Water-control structure components are constructed of the following materials.

- Asbestos cement board
- Carbon steel
- Concrete
- Concrete block
- Rock/stone

Environments

Water-control structure components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Exposed to fluid environment
- Soil

Aging Effects Requiring Management

The following aging effects associated with water-control structure components require management.

- Cracking

- Increase in porosity and permeability
- Loss of bond
- Loss of form
- Loss of material
- Loss of strength

Aging Management Programs

The following aging management programs manage the effects of aging on water-control structure components.

- Fire Protection
- Masonry Wall
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Structures Monitoring

3.5.2.1.3 Turbine Building, Process Facilities, and Yard Structures

Materials

Turbine building, process facilities, and yard structure components are constructed of the following materials.

- Carbon steel
- Concrete
- Concrete block
- Galvanized steel
- Stainless steel

Environments

Turbine building, process facilities, and yard structure components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Exposed to fluid environment
- Soil

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
- Reduction of strength and modulus

Aging Management Programs

The following aging management programs manage the effects of aging on the turbine building, process facilities, and yard structure components.

- Fire Protection
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Masonry Wall
- Structures Monitoring

3.5.2.1.4 Bulk Commodities

Materials

Bulk commodity components are constructed of the following materials.

- Aluminum
- Calcium silicate
- Carbon steel
- Carborundum durablanket
- Carborundum fibersil cloth
- Concrete
- Elastomers
- Fiberboard
- Fiberfrax
- Fiberfrax ceramic fiber durablanket
- Fiberglass
- Galvanized steel
- Insulfrax
- Silicone elastomers

- Stainless steel
- Thermo-lag

Environments

Bulk commodity components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Exposed to fluid environment
- Soil

Aging Effects Requiring Management

The following aging effects associated with bulk commodities require management.

- Change in material properties
- Cracking
- Cracking/delamination, separation
- 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.

- Fire Protection
- Fire Water System
- Inservice Inspection – IWF
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Structures Monitoring
- Water Chemistry Control – BWR

3.5.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.5.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the Fermi 2 approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Cracking and Distortion due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, and Cracking due to Differential Settlement and Erosion of Porous Concrete Subfoundations

The Fermi 2 containment is a BWR Mark I steel containment vessel (SCV). The containment is a carbon steel structure comprised of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The Fermi 2 SCV structure's concrete base foundation is integral with the concrete base foundation of the reactor building, which is founded on bedrock. No geologic conditions are known that could have an adverse effect on the safety of plant facilities. Therefore, cracking and distortion due to increased stress levels from settlement is not applicable to the Fermi 2 SCV structure's concrete base foundation.

Fermi 2 does not rely on a dewatering system for control of settlement. The Fermi 2 SCV concrete base foundation is founded on bedrock and does not use a porous concrete subfoundation. Additionally, Information Notice 97-11 did not identify Fermi 2 as a plant susceptible to erosion of porous concrete subfoundations. Therefore, reduction of foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations is not applicable to the Fermi 2 SCV structure's concrete base foundation.

3.5.2.2.1.2 Reduction of Strength and Modulus due to Elevated Temperature

The Fermi 2 containment is a BWR Mark I SCV. The containment is a carbon steel structure comprised of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The Fermi 2 SCV structure's concrete base foundation is integral with the concrete base foundation of the reactor building, which is founded on bedrock.

During normal operation, areas within containment are maintained below a general temperature of 150°F by a drywell cooling system. Process piping carrying hot fluid (pipe temperature > 200°F) are routed through penetrations in the SCV that are not encased in concrete, thus the local area temperatures greater than 200°F is not applicable for the Fermi 2 containment concrete. Therefore, change in material properties due to elevated temperature is not an aging effect requiring management for the Fermi 2 containment concrete.

3.5.2.2.1.3 Loss of Material due to General, Pitting and Crevice Corrosion

1. Loss of material due to general, pitting, and crevice corrosion could occur in steel elements of inaccessible areas for all types of PWR and BWR containments.

   The Fermi 2 containment is a BWR Mark I SCV. The containment is a carbon steel structure comprised of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. A moisture barrier is provided where the steel shell becomes embedded in the concrete floor within the drywell. The SCV is inspected in accordance with the requirements of ASME Code Section XI, Subsection IWE. These inspections include a visual examination of the accessible interior and the exterior surfaces of the class MC components, parts and appurtenances of the SCV as well as visual inspection of the moisture barrier at the concrete-to-steel interface. Loss of material due to general, pitting and crevice corrosion of the steel elements of accessible areas is managed by the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program (10 CFR Part 50, Appendix J Program). Interior concrete is monitored for cracks under the Structures Monitoring Program.

   To prevent corrosion of the lower part of the drywell shell, the interior and exterior surfaces are protected from contact with the atmosphere by complete concrete encasement. It is not credible for ground water to reach the drywell shell, assuming a crack in the concrete, because the concrete at this location is greater than eight feet thick and poured in multiple horizontal planes. The sand cushion area contains drains to protect the exterior surface of the drywell shell at the sand cushion interface from water that might enter the air gap. The exterior of the drywell shell has a galvanic corrosion protection, and inspection activities ensure that excessive moisture levels on the exterior portion of the steel containment drywell shell are identified. Therefore, significant corrosion of the drywell shell is not expected.

   The continued monitoring of the Fermi 2 SCV structure for loss of material due to general, pitting, and crevice corrosion through the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program provides reasonable assurance that loss of material in inaccessible areas of Fermi 2 containment will be detected prior to a loss of an intended function.

2. Loss of material due to general, pitting, and crevice corrosion could occur in steel torus shell of Mark I containments.

   The Fermi 2 containment is a BWR Mark I SCV. The containment is a carbon steel structure comprised of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The SCV, which includes the steel torus shell, is inspected in accordance with the requirements of ASME Code Section XI, Subsection IWE. These inspections include a visual examination of the accessible interior and the exterior surfaces of the class MC components, parts and appurtenances of the SCV, including the steel torus shell. Loss of material due to general, pitting and crevice corrosion of the steel elements of accessible areas is managed by the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program (10 CFR Part 50, Appendix J Program).

The continued monitoring of the Fermi 2 SCV, including the steel torus shell, for loss of material due to general, pitting, and crevice corrosion through the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program provides reasonable assurance that loss of material of the SCV, including the steel torus shell, will be detected prior to a loss of an intended function.

3. Loss of material due to general, pitting, and crevice corrosion could occur in steel torus ring girders and downcomers of Mark I containments, downcomers of Mark II containments, and interior surface of suppression chamber shell of Mark III containments.

   The Fermi 2 containment is a BWR Mark I SCV. The containment is a carbon steel structure comprised of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The SCV, which includes the steel torus ring girders and downcomers, is inspected in accordance with the requirements of ASME Code Section XI, Subsection IWE. These inspections include a visual examination of the accessible interior and the exterior surfaces of the class MC components, parts and appurtenances of the SCV, including the steel torus ring girders and downcomers. Loss of material due to general, pitting and crevice corrosion of the steel elements of accessible areas is managed by the Containment Inservice Inspection – IWE Program.

   The continued monitoring of the Fermi 2 SCV, including the steel torus ring girders and downcomers, for loss of material due to general, pitting, and crevice corrosion through the Containment Inservice Inspection – IWE Program provides reasonable assurance that loss of material of the SCV, including the steel torus ring girders and downcomers, will be detected prior to a loss of an intended function.

3.5.2.2.1.4 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

The Fermi 2 containment is a BWR Mark I SCV structure consisting of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The Fermi 2 SCV design does not contain prestressed tendons. Therefore, loss of prestress due to relaxation, shrinkage, creep, and elevated temperature does not apply.

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.

3.5.2.2.1.6 Cracking due to Stress Corrosion Cracking

NUREG-1801 recommends further evaluation of inspection methods to detect cracking due to stress corrosion cracking (SCC) since visual VT-3 examinations may be unable to detect this aging effect. Potentially susceptible components at Fermi 2 are penetration sleeves and bellows.

Three factors are necessary to initiate and propagate cracking due to SCC, including transgranular stress corrosion cracking (TGSCC). These factors are susceptible or sensitized material (resulting from manufacturing or installation process), a high tensile stress (residual or applied), and corrosive environment (high temperatures, moist or wetted environment or an environment contaminated with chlorides, fluorides, or sulfates). Elimination or reduction of any of these factors will decrease the likelihood of SCC. TGSCC of Fermi 2 stainless steel bellows is not considered credible because the corrosive environment (concentration of chloride or sulfate contaminants and temperatures greater than 140°F) does not exist for the bellows. Therefore, SCC of Fermi 2 stainless steel bellows due to TGSCC is not expected. A review of plant operating experience did not identify cracking of this component, and containment pressure boundary functions have not been identified as a concern.

SCC is not an applicable aging mechanism for the SCV carbon steel penetration sleeves and dissimilar metal welds. The Fermi 2 SCV and associated penetration sleeves are carbon steel. High temperature piping systems penetrating the containment are generally carbon steel. Stress corrosion cracking is only applicable to stainless steel and is predicted only under certain conditions as discussed above. SCC of dissimilar metal welds of stainless steel at the penetration sleeves is not considered credible because stainless steel SCC requires a concentration of chloride or sulfate contaminants, which are not present in significant quantities, as well as high stress and temperatures greater than 140°F. Leakage of water in the containment, which might contact the penetration sleeves, is not the normal operating environment. The containment pressure boundary welds between stainless steel piping and penetration sleeves, with normal operating temperatures above 140°F, are not highly stressed. In addition, the Technical Specification limits the average air temperature inside the primary containment during normal plant operation to 145°F. A review of plant operating experience did not identify cracking of these components, and containment pressure boundary functions have not been identified as a concern. Therefore, cracking of these components due to stress corrosion cracking is not expected. Nevertheless, the Containment Inservice Inspection – IWE Program and the

Containment Leak Rate Program manage cracking due to SCC of stainless steel bellows and dissimilar metal welds for carbon steel and stainless steel.

3.5.2.2.1.7 Loss of Material (Scaling, Spalling) and Cracking due to Freeze-Thaw

The Fermi 2 containment is a BWR Mark I SCV. The containment is a carbon steel SCV structure consisting of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The Fermi 2 SCV structure's concrete base foundation is integral with the concrete base foundation of the reactor building. The concrete base foundation of the SCV is below grade and protected from the outer environment by the reactor building's base foundation and is not subject to freeze-thaw action.

Therefore, loss of material and cracking due to freeze-thaw are not aging effects requiring management for the Fermi 2 SCV concrete base foundation.

3.5.2.2.1.8 Cracking due to Expansion from Reaction with Aggregate

The Fermi 2 containment is a BWR Mark I SCV. The containment is a carbon steel SCV structure consisting of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The Fermi 2 SCV structure's concrete base foundation is integral with the concrete base foundation of the reactor building.

The Fermi 2 SCV concrete base foundation is designed in accordance with American Concrete Institute (ACI) 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, Canadian Standards Association (CSA), Michigan Department of State Highways, and American Society for Testing and Materials (ASTM) standards. The concrete mix uses Portland cement conforming to ASTM C150 (Types I, II and V) or CSA Standard A5 along with fly ash (ASTM C618). Concrete aggregates conform to the requirements of Michigan Department of State Highways Standard Specifications for Road and Bridge Construction, Article 8.02. Fine aggregates are of the natural sand designation 2NS. Coarse aggregates are of the designation 6AA; these requirements equal or exceed those of ASTM Specification C33. The aggregate used in the concrete of the Fermi 2 components did not come from a region known to yield aggregates suspected of or known to cause aggregate reactions. Materials for concrete used in Fermi 2 structures and components were specifically investigated, tested, and examined in accordance with pertinent Michigan Department of State Highways and ASTM standards. If potentially reactive aggregates were encountered, then use of a low alkali Portland cement containing less than 0.60 percent alkali, calculated as sodium oxide equivalent, was used to prevent harmful expansion due to alkali aggregate reaction. Additionally, water/cement ratios were within the acceptable range defined in ACI 318. Nevertheless, based on ongoing industry operating experience, the Structures Monitoring Program manages cracking due to expansion from reaction with aggregate in accessible concrete areas for the Fermi 2 SCV concrete base foundation.

3.5.2.2.1.9 Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide and Carbonation

The Fermi 2 containment is a BWR Mark I SCV. The containment is a carbon steel SCV structure consisting of a drywell, a torus or suppression chamber, and a vent system connecting the drywell and the torus. The Fermi 2 SCV structure's concrete base foundation is integral with the concrete base foundation of the reactor building.

The Fermi 2 SCV concrete base foundation is designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, CSA, Michigan Department of State Highways, and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete. Cracking is controlled through proper arrangement and distribution of reinforcing steel. The Fermi 2 SCV structure's concrete base foundation is constructed of a dense, well-cured concrete with an amount of cement suitable for strength development and achievement of a water-to-cement ratio which is characteristic of concrete having low permeability. The Fermi 2 SCV structure's concrete base foundation is integral with the concrete base foundation of the reactor building. The base foundation of the SCV is below grade and protected from the outer environment by the reactor building's concrete base foundation and is not subject to the flowing water environment necessary for this aging effect to occur.

Therefore, increase in porosity and permeability due to leaching of calcium hydroxide and carbonation are not aging effects requiring management for the Fermi 2 SCV concrete base foundation.

3.5.2.2.2 <u>Safety-Related and Other Structures and Component Supports</u>

Structure groups and component support groups as used in the following discussions are defined in NUREG-1800, Section 3.5.1.

3.5.2.2.2.1 Aging Management of Inaccessible Areas

1. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw in Below-Grade Inaccessible Concrete Areas of Groups 1-3, 5, and 7-9 Structures

   The Fermi 2 Groups 1-3, 5 and 7-9 concrete structures are located in a region where weathering conditions are considered severe as shown in ASTM C33-90, Fig. 1. The concrete structures are designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, CSA, Michigan Department of State Highways, and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150 (Types II and V) or CSA Standard A5 along with flyash (ASTM C618). Concrete aggregates conform to the requirements of Michigan Department of State Highways Standard Specifications for Road and Bridge Construction, Article 8.02. Fine aggregates are of the natural sand designation 2NS. Coarse aggregates are of the designation 6AA; these requirements equal or exceed those of ASTM Specification C33. The type and size of aggregate, slump, cement and additives have been established to produce durable concrete in accordance with ACI. Additionally, water/cement ratios were within the acceptable range defined in ACI 318. Fermi 2 specifications require an air-entraining agent to be used in concrete subject to weathering. Fermi 2 specifications provide a durable concrete that is not subject to freeze-thaw aging effects.

Nevertheless, the Structures Monitoring Program will manage loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete of Groups 1-3, 5 and 7-9 structures. These structures will be inspected when accessible as a result of excavation for any reason. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring.

2. Cracking Due to Expansion and Reaction with Aggregates in Below-Grade Inaccessible Concrete Areas for Groups 1-5 and 7-9 Structures

   The Fermi 2 Groups 1-5 and 7-9 concrete structures are designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, CSA, Michigan Department of State Highways, and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150 (Types II and V) or CSA Standard A5 along with flyash (ASTM C618). Concrete aggregates conform to the requirements of Michigan Department of State Highways Standard Specifications for Road and Bridge Construction, Article 8.02. Fine aggregates are of the natural sand designation 2NS. Coarse aggregates are of the designation 6AA; these requirements equal or exceed those of ASTM Specification C33. The aggregate used in the concrete of the Fermi 2 components did not come from a region known to yield aggregates suspected of or known to cause aggregate reactions. Materials for concrete used in Fermi 2 structures and components were specifically investigated, tested, and examined in accordance with pertinent Michigan Department of State Highways and ASTM standards. If potentially reactive aggregates were encountered, then use of a low alkali Portland cement containing less than 0.60 percent alkali, calculated as sodium oxide equivalent, was used to prevent harmful expansion due to alkali aggregate reaction. Additionally, water/cement ratios were within the acceptable range defined in ACI 318. Nevertheless, based on ongoing industry operating experience, the Structures Monitoring Program manages cracking due to expansion from reaction with aggregate in below-grade inaccessible concrete for Groups 1-5 and 7-9 concrete structures.

3. Cracking and Distortion Due to Increased Stress Levels from Settlement for Below Grade Inaccessible Concrete Areas of Structures for all Groups and Reduction in Foundation Strength, and Cracking, due to Differential Settlement and Erosion of Porous Concrete Subfoundation in Below-Grade Inaccessible Concrete Areas for Groups 1-3, 5-9 Structures

   The Groups 1-3 and 5-9 concrete structures at Fermi 2, except for process facilities and yard structures which are founded on soil or compacted structural backfill, are founded on bedrock. For the inaccessible concrete of Groups 1-3 and 5-9 Structures at Fermi 2 that are founded on the bedrock, the aging effect cracking and distortion due to increased stress levels from settlement is not applicable. For Fermi 2 concrete structures founded on compacted structural backfill or soil, the aging effect cracking and distortion due to increased stress levels from settlement is conservatively applied as an aging effect requiring management and will be managed by the Structures Monitoring Program. Therefore, cracking and distortion due to increased stress levels from settlement for below-grade inaccessible concrete areas is not an applicable aging effect for Fermi 2 Groups 1-3 and 5-9 concrete structures, except for process facilities and yard structures, which will be managed by the Structures Monitoring Program.

   The Groups 1-3 and 5-9 concrete structures at Fermi 2 do not rely on a dewatering system for control of settlement. The Groups 1-3 and 5-9 concrete structures do not use porous concrete subfoundations. Additionally, Information Notice 97-11 did not identify Fermi 2 as a plant susceptible to erosion of porous concrete subfoundations. Therefore, reduction of foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations in below-grade inaccessible concrete areas is not an applicable aging effect for Fermi 2 Groups 1-3 and 5-9 concrete structures.

4. Increase in Porosity and Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide and Carbonation of Below-Grade Inaccessible Concrete Areas of Groups 1-5 and 7-9 Structures

   The Fermi 2 Groups 1-5 and 7-9 concrete structures are designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, CSA, Michigan Department of State Highways and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete. The concrete mix uses Portland cement conforming to ASTM C150 (Types II and V) or CSA Standard A5 along with flyash (ASTM C618). Concrete aggregates conform to the requirements of Michigan Department of State Highways Standard Specifications for Road and Bridge Construction, Article 8.02. Fine aggregates are of the natural sand designation 2NS. Coarse aggregates are of the designation 6AA; these requirements equal or exceed those of ASTM Specification C33. The type and size of aggregate, slump, cement and additives have been established to produce durable concrete in accordance with ACI. Cracking is controlled through proper arrangement and distribution of reinforcing steel. Concrete structures and concrete components are constructed of a dense, well-cured concrete with an amount of cement suitable for strength development and achievement of a water-to-cement ratio that is characteristic of concrete having low permeability. This is consistent with the recommendations and guidance provided by ACI 201.2R-77. The Fermi 2 Groups 1-5 and 7-9 concrete structures are not subject to the flowing water environment necessary for this aging effect to occur.

Therefore, increase in porosity and permeability due to leaching of calcium hydroxide and carbonation in below-grade inaccessible concrete areas is not an applicable aging effect for the inaccessible concrete of Fermi 2 Groups 1-5 and 7-9 concrete structures. However, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring.

3.5.2.2.2.2 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

ACI 349 specifies concrete temperature limits for normal operations or any other long-term period. With the exception of the main steam tunnel (pipe tunnel) in the turbine building, Fermi 2 Group 1-5 concrete structures are maintained below a general temperature of 150°F during normal operation by plant cooling systems. Process piping carrying hot fluid (pipe temperature > 200°F) routed through penetrations in the concrete walls by design do not result in temperatures exceeding 200°F locally or result in "hot spot" on the concrete surface. The penetration configuration includes guard pipes and insulation of the process piping to minimize heat transfer from the process pipe to the exterior environment surrounding the process piping.

Therefore, change in material properties due to elevated temperature is not an aging effect requiring management for Fermi 2 Group 1-5 concrete structures, with the exception of the main steam tunnel (pipe tunnel) in the turbine building. For the main steam tunnel (pipe tunnel) in the turbine building, the Structures Monitoring Program manages change in material properties due to elevated temperature for Groups 1-5 concrete structures. The aging effect "change in material properties" is equivalent to the NUREG-1801 aging effect "reduction of strength and modulus of elasticity."

3.5.2.2.2.3 Aging Management of Inaccessible Areas for Group 6 Structures

For inaccessible areas of certain Group 6 structures, aging effects are covered by inspections in accordance with the Structures Monitoring Program.

1. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-thaw in Below-Grade Inaccessible Concrete Areas of Group 6 Structures

   Fermi 2 is located in a region where weathering conditions are considered severe as shown in ASTM C33-90, Fig. 1. The Group 6 concrete structures are designed in accordance with ACI 318-63 or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, CSA, Michigan Department of State Highways and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150 (Types II and V) or CSA Standard A5 along with flyash (ASTM C618). Concrete aggregates conform to the requirements of Michigan Department of State Highways Standard Specifications for Road and Bridge Construction, Article 8.02. Fine aggregates are of the natural sand designation 2NS. Coarse aggregates are of the designation 6AA; these requirements equal or exceed those of ASTM Specification C33. The type and size of aggregate, slump, cement and additives have been established to produce durable concrete in accordance with ACI. Additionally, water/cement ratios were within the acceptable range defined in ACI 318. Fermi 2 specifications require an air-entraining agent to be used in concrete subject to weathering. Fermi 2 specifications provide a durable concrete that is not subject to freeze-thaw aging effects.

   Therefore, loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete are not aging effects that require aging management. Nevertheless, the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade (above the frost line) concrete for Fermi 2 Group 6 concrete structures. These structures will be inspected when accessible as a result of excavation for any reason. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring.

2. Cracking Due to Expansion and Reaction with Aggregates in Below-Grade Inaccessible Concrete Areas of Group 6 Structures

   The Fermi 2 Group 6 concrete structures are designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, CSA, Michigan Department of State Highways and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150 (Types II and V) or CSA Standard A5 along with flyash (ASTM C618). Concrete aggregates conform to the requirements of Michigan Department of State Highways Standard Specifications for Road and Bridge Construction, Article 8.02. Fine aggregates are of the natural sand designation 2NS. Coarse aggregates are of the designation 6AA; these requirements equal or exceed those of ASTM

Specification C33. The aggregate used in the concrete of the Fermi 2 components did not come from a region known to yield aggregates suspected of or known to cause aggregate reactions. Materials for concrete used in Fermi 2 structures and components were specifically investigated, tested, and examined in accordance with pertinent Michigan Department of State Highways and ASTM standards. If potentially reactive aggregates were encountered, then use of a low alkali Portland cement containing less than 0.60 percent alkali, calculated as sodium oxide equivalent, was used to prevent harmful expansion due to alkali aggregate reaction. Additionally, water/cement ratios were within the acceptable range defined in ACI 318. Nevertheless, based on ongoing industry operating experience, the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages cracking due to expansion from reaction with aggregate in below-grade inaccessible concrete areas for Fermi 2 Group 6 concrete structures.

3. Increase in Porosity and Permeability and Loss of Strength due to Leaching of Calcium Hydroxide and Carbonation in Inaccessible Areas of Concrete Elements of Group 6 Structures

   The Fermi 2 Group 6 concrete structures are designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI, CSA, Michigan Department of State Highways and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete. The concrete mix uses Portland cement conforming to ASTM C150 (Types II and V) or CSA Standard A5 along with flyash (ASTM C618). Concrete aggregates conform to the requirements of Michigan Department of State Highways Standard Specifications for Road and Bridge Construction, Article 8.02. Fine aggregates are of the natural sand designation 2NS. Coarse aggregates are of the designation 6AA; these requirements equal or exceed those of ASTM Specification C33. The type and size of aggregate, slump, cement and additives have been established to produce durable concrete in accordance with ACI. Cracking is controlled through proper arrangement and distribution of reinforcing steel. Concrete structures and concrete components are constructed of a dense, well-cured concrete with an amount of cement suitable for strength development and achievement of a water-to-cement ratio that is characteristic of concrete having low permeability. This is consistent with the recommendations and guidance provided by ACI 201.2R-77. The Fermi 2 Group 6 concrete structures are not subject to the flowing water environment necessary for this aging effect to occur.

   Therefore, increase in porosity and permeability due to leaching of calcium hydroxide and carbonation in below-grade inaccessible concrete areas is not an applicable aging effect for the inaccessible concrete of Fermi 2 Group 6 concrete structures. Nevertheless, the RG 1.127, Inspection of Water-Control Structures

Associated with Nuclear Power Plants Program manages increase in porosity and permeability due to leaching of calcium hydroxide and carbonation in below grade inaccessible concrete areas of inaccessible concrete of Fermi 2 Group 6 concrete structures.

3.5.2.2.2.4 Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion

NUREG-1800 Section 3.5.2.2.2.4 applies to stainless steel liners for concrete or steel tanks. No tanks with stainless steel liners are included in the structural scope of license renewal. However, the corresponding NUREG-1801 items can be compared to the stainless steel liners of other components, such as reactor cavity and containment sump. These liners can be exposed to a fluid environment and may be subject to loss of material. The fluid temperatures are below the threshold value of < 140°F (< 60°C) for stress corrosion cracking. The Structures Monitoring Program manages loss of material by periodic inspections.

3.5.2.2.2.5 Cumulative Fatigue Damage due to Fatigue

TLAA are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4 of this application. During the process of identifying TLAAs in the Fermi 2 current licensing basis, no fatigue analyses were identified for component support members, welds, and support anchorage to building structure for Groups B1.1, B1.2, and B1.3.

3.5.2.2.3 <u>Quality Assurance for Aging Management of Nonsafety-Related Components</u>

See Appendix B Section B.0.3 for discussion of Fermi 2 quality assurance procedures and administrative controls for aging management programs.

3.5.2.2.4 <u>Ongoing Review of Operating Experience</u>

See Appendix B Section B.0.4 for discussion of Fermi 2 operating experience review programs.

3.5.2.3 Time-Limited Aging Analyses

Potential TLAA identified for structural components and commodities include fatigue analyses for drywell to torus vent system, torus shell, reactor building crane structural girders, bellows and refueling bellows assembly, and torus penetrations. TLAAs are discussed in Section 4.

3.5.3 <u>Conclusion</u>

The structural components and commodities subject to aging management review have been identified in accordance with the criteria of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on structural components and commodities are identified in Section 3.5.2.1 and the following tables. A description of the aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the structural components and commodities will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.5.1
Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
PWR Concrete (Reinforced and Prestressed) and Steel Containments, BWR Concrete and Steel (Mark I, II, and III) Containments					
3.5.1-1	Concrete: dome; wall; basemat; ring girders; buttresses, Concrete elements, all	Cracking and distortion due to increased stress levels from settlement	ISI (IWL) or Structures Monitoring Program If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Fermi 2 has a Mark I steel containment structure. The listed concrete elements apply to PWR containments and concrete BWR containments. Fermi 2 does not rely on a de-watering system to control settlement. Therefore, this aging effect and mechanism is not applicable to the Fermi 2 primary containment. For further evaluation, see Section 3.5.2.2.1.1.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-2	Concrete; foundation; subfoundation	Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation	Structures Monitoring Program. If a de-watering system is relied upon for control of erosion, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment structure type. Concrete elements are limited to floor slab and reactor vessel pedestal and are founded on the reactor building slab. These concrete elements do not have a porous concrete subfoundation or rely on a de-watering system to control settlement. For further evaluation, see Section 3.5.2.2.1.1.

Table 3.5.1: Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-3	Concrete: dome; wall; basemat; ring girders; buttresses, Concrete: containment; wall; basemat, Concrete: basemat, concrete fill-in annulus	Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment structure type. Concrete elements are limited to floor slab and reactor vessel pedestal. Fermi 2 is a Mark I primary containment and concrete is not exposed to general temperatures that exceed the threshold. Therefore, these aging effects and mechanisms are not applicable to the Fermi 2 primary containment. For further evaluation, see Section 3.5.2.2.1.2.
3.5.1-4	Steel elements (inaccessible areas): drywell shell; drywell head; and drywell shell	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, if corrosion is indicated from the IWE examinations	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and the Containment Leak Rate Programs manage the loss of material of steel elements (inaccessible areas), drywell shell; drywell head, and drywell shell in sand pocket region (as applicable). For further discussion see Section 3.5.2.2.1.3 Item 1.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-5	Steel elements (inaccessible areas): liner; liner anchors; integral attachments, Steel elements (inaccessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, if corrosion is indicated from the IWE examinations.	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and the Containment Leak Rate Programs manage the loss of material of steel elements (inaccessible areas) for the torus shell. The loss of material for components drywell shell; drywell head; and drywell shell in sand pocket region are addressed in Item Number 3.5.1-4 (as applicable). Steel elements (inaccessible areas): liner; liner anchors; and integral attachments are applicable to PWR containments. For further evaluation, see Section 3.5.2.2.1.3 Item 1.
3.5.1-6	Steel elements: torus shell	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, if corrosion is significant, recoating of the torus is recommended.	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and the Containment Leak Rate Programs manage the loss of material of steel elements: torus shell. For further discussion, see Section 3.5.2.2.1.3 Item 2.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-7	Steel elements: torus ring girders; downcomers; Steel elements: suppression chamber shell (interior surface)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE)	Yes, if corrosion is significant	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE Program manages the loss of material of steel elements torus ring girders; downcomers; steel elements: torus shell (interior surface). For further discussion, see Section 3.5.2.2.1.3 Item 3.
3.5.1-8	Prestressing system; tendons	Loss of prestress due to relaxation, shrinkage, creep; elevated temperature	Yes, TLAA	Yes, TLAA	NUREG-1801 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. The Fermi 2 containment is a Mark I steel containment. For further evaluation, see Section 3.5.2.2.1.4.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-9	Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell; unbraced downcomers, Steel elements: vent header; downcomers	Cumulative fatigue damage due to fatigue (only if CLB fatigue analysis exists)	Yes, TLAA	Yes, TLAA	Consistent with NUREG-1801. Fatigue analysis is a TLAA. For further evaluation, see Section 3.5.2.2.1.5.
3.5.1-10	Penetration sleeves, penetration bellows	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect. For further evaluation see Section 3.5.2.2.1.6.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-11	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).	Yes, for plants located in moderate to severe weathering conditions	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment structure type. Concrete elements are limited to floor slab and reactor vessel pedestal. These elements are not subject to loss of material (spalling, scaling) and cracking due to freeze-thaw because they are founded on the reactor building base slab and not exposed to an air-outdoor environment. For further evaluation, see Section 3.5.2.2.1.7.

Table 3.5.1: Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-12	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): containment; wall; basemat, Concrete (inaccessible areas): basemat, concrete fill-in annulus	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated function	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel Containment structure type. For further evaluation, see Section 3.5.2.2.1.8.
3.5.1-13	Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type. For further evaluation, see Section 3.5.2.2.1.9.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-14	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): containment; wall; basemat	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type. For further evaluation, see Section 3.5.2.2.1.9.
3.5.1-15	Concrete (accessible areas): basemat.	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	ISI (IWL).	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.
3.5.1-16	Concrete (accessible areas): basemat, Concrete: containment; wall; basemat	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	ISI (IWL) or Structures Monitoring Program	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-17	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	ISI (IWL)	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.
3.5.1-18	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat	Loss of material (spalling, scaling) and cracking due to freeze-thaw	ISI (IWL)	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.
3.5.1-19	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat, Concrete (accessible areas) containment; wall; basemat, concrete fill-in annulus	Cracking due to expansion from reaction with aggregates	ISI (IWL)	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-20	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): containment; wall; basemat	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	ISI (IWL)	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.
3.5.1-21	Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel, Concrete (accessible areas): basemat; reinforcing steel, Concrete (accessible areas): dome; wall; basemat; reinforcing steel	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	ISI (IWL)	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.
3.5.1-22	Concrete (inaccessible areas): basemat; reinforcing steel	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-23	Concrete (inaccessible areas): basemat; reinforcing steel, Concrete (inaccessible areas): dome; wall; basemat; reinforcing steel	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	ISI (IWL) or Structures Monitoring Program	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.
3.5.1-24	Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (accessible areas): dome; wall; basemat	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	ISI (IWL) or Structures Monitoring Program	No	NUREG-1801 items referencing this item number are not associated with the Fermi 2 BWR Mark I steel containment type.
3.5.1-25	PWR only				
3.5.1-26	Moisture barriers (caulking, flashing, and other sealants)	Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects	ISI (IWE)	No	The Containment Inservice Inspection – IWE and Periodic Surveillance and Preventive Maintenance Programs manage the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-27	Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable. 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.
3.5.1-28	Personnel airlock, equipment hatch, CRD hatch	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect.
3.5.1-29	Personnel airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms	Loss of leak tightness due to mechanical wear of locks, hinges and closure mechanisms	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect.
3.5.1-30	Pressure-retaining bolting	Loss of preload due to self-loosening	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect.

Table 3.5.1: Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-31	Pressure-retaining bolting, Steel elements: downcomer pipes	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE)	No	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE Program manages the pressure-retaining bolting aging effect. Steel elements: downcomer pipes is addressed under Item 3.5.1-7.
3.5.1-32	Prestressing system: tendons; anchorage components	Loss of material due to corrosion	ISI (IWL)	No	NUREG-1801 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. The Fermi 2 containment is a Mark I steel containment.
3.5.1-33	Seals and gaskets	Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects	10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The Containment Leak Rate Program manages seals and gaskets for loss of sealing.
3.5.1-34	Service Level I coatings	Loss of coating integrity due to blistering, cracking, flaking, peeling, or physical damage	Protective Coating Monitoring and Maintenance Program	No	Consistent with NUREG-1801. The Protective Coating Monitoring and Maintenance Program manage the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-35	Steel elements (accessible areas): liner; liner anchors; integral attachments, Penetration sleeves, Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket regions; Steel elements (accessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable), Steel elements (accessible areas): drywell shell; drywell head	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect.

Table 3.5.1: Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-36	Steel elements: drywell head; downcomers	Fretting or lockup due to mechanical wear	ISI (IWE)	No	Loss of material is the aging effect caused by mechanical wear. Fermi 2 plant operating experience has not identified fretting or lock up due to mechanical wear for the drywell head and downcomers. Fermi 2 inspects the drywell head and downcomers per the requirements of ASME Section XI. In addition, the drywell head is a stationary or fixed component and the downcomers are stationary, well-braced components and the spatial distance between connecting components makes it unlikely for fretting and lock up to occur.
3.5.1-37	Steel elements: suppression chamber (torus) liner (interior surface)	Loss of material due to general (steel only), pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	NUREG-1801 items referencing this item are associated with BWR concrete containments. Fermi 2 is a Mark I containment. However, for similar components, steel elements: suppression chamber (torus) liner (interior surface), the listed aging effect is addressed under Item 3.5.1-7.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-38	Steel elements: suppression chamber shell (interior surface)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J	No	This NUREG-1801 item number is applicable to stainless steel suppression chamber shells of Mark III containments. The component, material, environment, and aging effect/mechanism combination does not apply to the Fermi 2 Mark I containment, which utilizes a carbon steel material for the suppression chamber liner surfaces.
3.5.1-39	Steel elements: vent line bellows	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect.
3.5.1-40	Unbraced downcomers, Steel elements: vent header; downcomers	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable. 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.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-41	Steel elements: drywell support skirt, Steel elements (inaccessible areas): support skirt	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
Safety-Related and Other Structures; and Component Supports					
3.5.1-42	Groups 1-3, 5, 7-9: Concrete (inaccessible areas): foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)	Yes, for plants located in moderate to severe weathering conditions	Listed aging effects for Fermi 2 concrete foundation do not require management. Fermi 2 concrete is designed and constructed in accordance with ACI 318 with air-entrainment. Concrete structures and concrete components are constructed of a dense, well-cured concrete with an amount of cement suitable for strength development and achievement of a water-to-cement ratio which is characteristic of concrete having low permeability. The design and construction of these structures at Fermi 2 prevents the effect of this aging from occurring; therefore, this aging effect does not require management. Aging effects are not significant for accessible and inaccessible areas. Nonetheless, the concrete foundation component is included in the Structures Monitoring Program to verify the absence of these aging effects. For further discussion, see Section 3.5.2.2.2.1 Item 1.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-43	All Groups except Group 6: Concrete (inaccessible areas): all	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. For further evaluation, see Section 3.5.2.2.2.1 Item 2.
3.5.1-44	All Groups: concrete: all	Cracking and distortion due to increased stress levels from settlement	Structures Monitoring Program If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. For further evaluation, see Section 3.5.2.2.2.1 Item 3.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-45	Groups 1-3, 5-9: concrete: foundation; subfoundation	Reduction in foundation strength, cracking due to differential settlement, erosion of porous concrete subfoundation	Structures Monitoring Program If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Not applicable. Category I structures at Fermi 2 are founded on bedrock. Fermi 2 structures do not utilize porous concrete subfoundations, do not rely on a de-watering system to control settlement, and do not have water flowing underneath the foundation. For further discussion, see Section 3.5.2.2.2.1 Item 3.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-46	Groups 1-3, 5-9: concrete: foundation; subfoundation	Reduction in foundation strength, cracking due to differential settlement, erosion of porous concrete subfoundation	Structures Monitoring Program If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Not applicable. Category I structures at Fermi 2 are founded on bedrock. Fermi 2 structures do not utilize porous concrete subfoundations, do not rely on a de-watering system to control settlement, and do not have water flowing underneath the foundation. For further evaluation, see Section 3.5.2.2.2.1 Item 3.
3.5.1-47	Groups 1-5, 7-9: concrete (inaccessible areas): exterior above and below-grade; foundation	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function	Not applicable. Category I structures at Fermi 2 are founded on bedrock and do not have water flowing underneath the foundation. Leaching has not been observed on accessible portions of Fermi 2 accessible concrete areas. For further evaluation, see Section 3.5.2.2.2.1 Item 4.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-48	Group 1-5: concrete: all	Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded	Listed aging effects do not require management at Fermi 2. Fermi 2 concrete in areas for this grouping are not exposed to temperatures that exceed the thresholds. For further evaluation, see Section 3.5.2.2.2.2.
3.5.1-49	Groups 6 – concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)	Yes, for plants located in moderate to severe weathering conditions	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect. For further evaluation, see Section 3.5.2.2.2.3 Item 1.
3.5.1-50	Groups 6: concrete (inaccessible areas): all	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if concrete is not constructed as stated	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect. For further evaluation, see Section 3.5.2.2.2.3 Item 2.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-51	Groups 6: concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes, if leaching is observed in accessible areas that impact intended function	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect. For further evaluation, see Section 3.5.2.2.2.3 Item 3.
3.5.1-52	Groups 7, 8 – steel components: tank liner	Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. For further evaluation, see Section 3.5.2.2.2.4
3.5.1-53	Support members; welds; bolted connections; support anchorage to building structure	Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	Yes, TLAA	Yes, TLAA	No CLB fatigue analysis exists for component supports members, welds, and support anchorage to building structure. For further evaluation, see Section 3.5.2.2.2.5.
3.5.1-54	All groups except 6: concrete (accessible areas): all	Cracking due to expansion from reaction with aggregates	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-55	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reduction in concrete anchor capacity due to local concrete degradation/ service induced cracking or other concrete aging mechanisms	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-56	Concrete: exterior above- and below-grade; foundation; interior slab	Loss of material due to abrasion; cavitation	Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect.
3.5.1-57	Constant and variable load spring hangers; guides; stops	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	Consistent with NUREG-1801. The Inservice Inspection – IWF (ISI-IWF) Program includes inspections capable of detecting loss of mechanical function due to distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-58	Earthen water-control structures: dams; embankments; reservoirs; channels; canals and ponds	Loss of material; loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage	Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effects.
3.5.1-59	Group 6: concrete (accessible areas): all	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effects.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-60	Group 6: concrete (accessible areas): exterior above- and below-grade; foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effects.
3.5.1-61	Group 6: concrete (accessible areas): exterior above- and below-grade; foundation; interior slab	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG 1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effects.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-62	Group 6: Wooden Piles; sheeting	Loss of material; change in material properties due to weathering, chemical degradation, and insect infestation repeated wetting and drying, fungal decay	Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	NUREG-1801 item referencing this item is associated with Group 6 water-control structures. Fermi 2 does not have the component of wooden piles; sheeting.
3.5.1-63	Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above and below-grade; foundation	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Structures Monitoring Program	No	Not applicable. Category I structures at Fermi 2 are founded on bedrock. Fermi 2 structures do not utilize porous concrete subfoundations, do not rely on a de-watering system to control settlement, and do not have water flowing underneath the foundation.
3.5.1-64	Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above and below-grade; foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-65	Groups 1-3, 5, 7-9: concrete (inaccessible areas): below-grade exterior; foundation, Groups 1-3, 5, 7-9: concrete (accessible areas): below-grade exterior; foundation, Groups 6: concrete (inaccessible areas): all	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-66	Groups 1-5, 7, 9: concrete (accessible areas): interior and above-grade exterior	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-67	Groups 1-5, 7, 9: Concrete: interior; above-grade exterior, Groups 1-3, 5, 7-9 -concrete (inaccessible areas): below-grade exterior; foundation, Group 6: concrete (inaccessible areas): all	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-68	High-strength structural bolting	Cracking due to stress corrosion cracking	ISI (IWF)	No	Listed aging effects do not require management at Fermi 2. Fermi 2 does not have high strength bolts that are subject to sustained high tensile stress in a corrosive environment. High strength bolts used in civil structures have not shown to be prone to SCC. Nonetheless, the bolting components in this listing are included in the ISI-IWF Program to confirm the absence of the listed aging effects.

Table 3.5.1: Structures and Component Supports					
Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-69	High-strength structural bolting	Cracking due to stress corrosion cracking	Structures Monitoring Program Note: ASTM A 325, F 1852, and ASTM A 490 bolts used in civil structures have not shown to be prone to SCC. SCC potential need not be evaluated for these bolts.	No	Listed aging effects do not require management at Fermi 2. Fermi 2 does not have high strength bolts that are subject to sustained high tensile stress in a corrosive environment. High strength bolts used in civil structures have not shown to be prone to SCC. Nonetheless, the bolting components in this listing are included in the Structures Monitoring Program to confirm the absence of the listed aging effects.
3.5.1-70	Masonry walls: all	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	Consistent with NUREG-1801. The Masonry Wall Program manages the listed aging effect.
3.5.1-71	Masonry walls: all	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Masonry Wall Program	No	Consistent with NUREG-1801. The Masonry Wall Program manages the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-72	Seals; gasket; moisture barriers (caulking, flashing, and other sealants)	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	The Structures Monitoring and Periodic Surveillance and Preventive Maintenance Programs manage the listed aging effect.
3.5.1-73	Service Level I coatings	Loss of coating integrity due to blistering, cracking, flaking, peeling, physical damage	Protective Coating Monitoring and Maintenance	No	Consistent with NUREG-1801. The Protective Coating Monitoring and Maintenance Program manages the listed aging effect.
3.5.1-74	Sliding support bearings; sliding support surfaces	Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear	Structures Monitoring Program	No	NUREG-1801 item referencing this item is associated with equipment supports, such as cable trays, HVAC duct, instrument tubing and mechanical equipment. Fermi 2 design does not use Lubrite, graphic tool steel, Fluorogold, or Lubrofluor for the component listed. Therefore aging management is not required.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-75	Sliding surfaces	Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear	ISI (IWF)	No	NUREG-1801 item referencing this item is associated with Lubrite plates. Lubrite plates are not subject to aging management because the listed aging mechanisms are event driven and typically can be avoided though proper design. Loss of material which could cause loss of mechanical function is addressed under Item 3.5.1-77 related to component support members.
3.5.1-76	Sliding surfaces: radial beam seats in BWR drywell	Loss of mechanical function due to corrosion, distortion, dirt, overload, wear	Structures Monitoring Program	No	NUREG-1801 item referencing this item is associated with Lubrite plates. Lubrite plates are not subject to aging management because the listed aging mechanisms are event driven and typically can be avoided though proper design. Loss of material which could cause loss of mechanical function is addressed under Item 3.5.1-77 related to component support members.
3.5.1-77	Steel components: all structural steel	Loss of material due to corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-78	Steel components: fuel pool liner	Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	Water Chemistry and Monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No, unless leakages have been detected through the SFP liner that cannot be accounted for from the leak chase channels	Consistent with NUREG-1801. The Water Chemistry Control – BWR Program and monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels manages the listed aging effects.
3.5.1-79	Steel components: piles	Loss of material due to corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-80	Structural bolting	Loss of material due to general, pitting and crevice corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-81	Structural bolting	Loss of material due to general, pitting and crevice corrosion	ISI (IWF)	No	Consistent with NUREG-1801. The ISI-IWF Program manages the listed aging effect.
3.5.1-82	Structural bolting	Loss of material due to general, pitting and crevice corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-83	Structural bolting	Loss of material due to general, pitting and crevice corrosion	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect.
3.5.1-84	Structural bolting	Loss of material due to pitting and crevice corrosion	Water Chemistry and ISI (IWF)	No	NUREG-1801 item referencing this item is associated with ASME Class MC stainless steel structural bolting in a fluid environment. Fermi 2 does not have this component/ material/environment combination.
3.5.1-85	Structural bolting	Loss of material due to pitting and crevice corrosion	Water Chemistry for BWR water, and ISI (IWF)	No	NUREG-1801 item referencing this item is associated with ASME Class 1, 2 and 3 stainless steel structural bolting in a fluid environment. Fermi 2 does not have this component/ material/ environment combination.

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-86	Structural bolting	Loss of material due to pitting and crevice corrosion	ISI (IWF)	No	Consistent with NUREG-1801. The ISI-IWF Program manages the listed aging effect.
3.5.1-87	Structural bolting	Loss of preload due to self-loosening	ISI (IWF)	No	Consistent with NUREG-1801. The ISI-IWF Program manages loss of preload due to self-loosening.
3.5.1-88	Structural bolting	Loss of preload due to self-loosening	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-89	PWR only				
3.5.1-90	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general (steel only), pitting, and crevice corrosion	Water Chemistry for BWR water, and ISI (IWF)	No	Consistent with NUREG-1801. The Water Chemistry Control-BWR and ISI-IWF Programs manage the listed aging effect.
3.5.1-91	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	ISI (IWF)	No	Consistent with NUREG-1801. The ISI-IWF Program manages the listed aging effect.
3.5.1-92	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	Structures Monitoring Program	No	The Structures Monitoring and Fire Water System Programs manage the listed aging effect.

Table 3.5.1: Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-93	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.
3.5.1-94	Vibration isolation elements	Reduction or loss of isolation function due to radiation hardening, temperature, humidity, sustained vibratory loading	ISI (IWF)	No	The Structures Monitoring Program is substituted for the ISI-IWF Program and manages the listed aging effects.
3.5.1-95	Aluminum, galvanized steel and stainless steel support members; welds; bolted connections; support anchorage to building structure exposed to Air – indoor, uncontrolled	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.

Notes for Table 3.5.2-1 through 3.5.2-4

Generic Notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

501. The drywell support skirt is embedded in the concrete of the reactor pedestal and is similar to concrete reinforcing environment. Therefore, this component aging is addressed by the surrounding concrete aging management program.

502. Because steel piles driven into undisturbed soils are unaffected by corrosion and because steel piles driven into disturbed soils have experienced only minor to moderate corrosion that does not significantly affect continued safety function performance during the license renewal term, no aging management is required.

Table 3.5.2-1
Reactor/Auxiliary Building and Primary Containment
Summary of Aging Management Evaluation

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
Control room ceiling support system	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	C
CRD housing support steel	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5.TP-43	3.5.1-92	A
Drywell personnel access airlock, equipment hatch, CRD hatch	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4.C-16	3.5.1-28	A
Drywell personnel access airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms	EN, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of leak tightness	CII-IWE Containment Leak Rate	II.B4.CP-39	3.5.1-29	A
Drywell personnel airlock, equipment hatch, CRD hatch and drywell head pressure retaining bolting	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE	II.B4.CP-148	3.5.1-31	A

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**
Drywell personnel airlock, equipment hatch, CRD hatch and drywell head pressure retaining bolting	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of preload	CII-IWE Containment Leak Rate	II.B4.CP-150	3.5.1-30	A
Drywell shell or torus deflectors	EN, MB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A8.TP-302	3.5.1-77	A
Drywell sump liner	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A7.T-23	3.5.1-52	E
Earthquake-stabilizer truss system	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.B5.TP-43	3.5.1-92	A
Hardened vent stack	SNS	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Metal siding	EN, PB, PR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B5.TP-8	3.5.1-95	A
Metal siding	EN, PB, PR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A
Metal siding	EN, PB, PR	Aluminum	Air – indoor uncontrolled	None	None	III.B5.TP-8	3.5.1-95	A
Metal siding	EN, PB, PR	Aluminum	Air – outdoor	Loss of material	Structures Monitoring	III.B4.TP-6	3.5.1-93	A

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
Penetration bellows	PB, SSR	Stainless steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B4.C-13	3.5.1-9	A
Penetration bellows	PB, SSR	Stainless steel	Air – indoor uncontrolled	Cracking	CII-IWE Containment Leak Rate	II.B4.CP-38	3.5.1-10	A
Pressure relief doors in steam tunnel	PR, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	C
Primary containment electrical penetration sleeves	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4.CP-36	3.5.1-35	A
Primary containment mechanical penetration sleeves	PB, SSR	Carbon steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B4.C-13	3.5.1-9	A
Primary containment mechanical penetration sleeves	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4.CP-36	3.5.1-35	A
Railroad airlock doors	EN, FLB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	C
Railroad airlock doors	EN, FLB, PB, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	C

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**
Railroad airlock doors	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	C
Railroad airlock doors	FB	Carbon steel	Air – outdoor	Loss of material	Fire Protection	VII.G.A-22	3.3.1-59	C
RCIC blow-off hatch	PR, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	C
Reactor building crane- rails and structural girders	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Inspection of OVHLL	VII.B.A-07	3.3.1-52	A
Reactor building crane- structural girders	SNS	Carbon steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	VII.B.A-06	3.3.1-1	A
Reactor building sump liner	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A7.T-23	3.5.1-52	E
Reactor cavity liner	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR	III.A5.T-14	3.5.1-78	E
Reactor cavity liner	EN, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B5.TP-8	3.5.1-95	A
Reactor vessel support assembly	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1.T-24	3.5.1-91	A
Refueling bellows assembly	EN, FLB, SNS	Stainless steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B4.C-13	3.5.1-9	A

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
Refueling bellows assembly	EN, FLB, SNS	Stainless steel	Air – indoor uncontrolled	None	None	III.B5.TP-8	3.5.1-95	A
Refueling bellows assembly	EN, FLB, SNS	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR	III.A5.T-14	3.5.1-78	E
Refueling bellows assembly	EN, FLB, SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	A
Refueling platform equipment assembly and rails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Inspection of OVHLL	VII.B.A-07	3.3.1-52	A
Roof decking	EN, PB	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2.TP-8	3.5.1-95	C
Sacrificial shield wall (steel portion including shielding doors)	EN, MB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	A
SGTS exhaust stack	SNS	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Shield plug	EN, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B5.TP-8	3.5.1-95	A
Skimmer surge tank	SNS	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR	III.A5.T-14	3.5.1-78	E

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**
Spent fuel storage pool liner plate	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR Monitoring of spent fuel storage pool level per Tech Spec and monitoring leakage from leak chase channel	III.A5.T-14	3.5.1-78	A
Spent fuel storage pool gates	EN, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR Monitoring of spent fuel storage pool level per Tech Spec and monitoring leakage from leak chase channel	III.A5.T-14	3.5.1-78	C
Steel components: beams, columns and plates	EN, MB, SNS, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	A
Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket region	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1.CP-43	3.5.1-35	C

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 (inaccessible areas): drywell shell; drywell shell in sand pocket region	EN, MB, PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B1.1.CP-63	3.5.1-4	C
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
Steel components: monorails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	C
Steel elements: drywell support skirt	SSR	Carbon steel	Concrete	None	None	II.B1.1.CP-44	3.5.1-41	A, 501
Steel elements: torus ring girders; downcomers	SSR	Carbon steel	Air – indoor uncontrolled or Exposed to fluid environment	Loss of material	CII-IWE	II.B1.1.CP-109	3.5.1-7	A
Steel elements: torus shell	HS, PB, SSR	Carbon steel	Air – indoor uncontrolled or Exposed to fluid environment	Loss of material	CII-IWE Containment Leak Rate	II.B1.1.CP-48	3.5.1-6	A

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 (inaccessible): torus shell	HS, PB, SSR	Carbon steel	Air – indoor uncontrolled or Exposed to fluid environment	Loss of material	CII-IWE Containment Leak Rate	II.B1.2.CP-63	3.5.1-5	A
Steel elements: torus shell	HS, PB, SSR	Carbon steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B1.1.C-21	3.5.1-9	A
Steel elements: torus; vent line; vent header; vent line bellows; downcomers	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE	II.B1.1.CP-109	3.5.1-7	A
Steel elements: torus; vent line; vent header; vent line bellows; downcomers	PB, SSR	Carbon steel; Stainless steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B1.1.C-21	3.5.1-9	A
Steel elements: vent line bellows	PB, SSR	Stainless steel	Air – indoor uncontrolled	Cracking	CII-IWE Containment Leak Rate	II.B1.1.CP-50	3.5.1-39	A
Torus electrical penetrations sleeves	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4.CP-36	3.5.1-35	A
Torus external supports (columns, saddles)	SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1.T-24	3.5.1-91	A

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
Torus manway covers	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4.C-16	3.5.1-28	A
Torus mechanical penetration sleeves	PB, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	CII-IWE Containment Leak Rate	II.B4.CP-36	3.5.1-35	A
Torus mechanical penetration sleeves	PB, SSR	Carbon steel	Air – indoor uncontrolled	Cracking	TLAA – metal fatigue	II.B4.C-13	3.5.1-9	A
Vent header support	SSR	Carbon steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR ISI-IWF	III.B1.1.TP-10	3.5.1-90	A
Biological shield wall	EN, MB, SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-26	3.5.1-66	A
Biological shield wall	EN, MB, SSR	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28	3.5.1-67	A
Biological shield wall	EN, MB, SSR	Concrete	Air – indoor uncontrolled	Cracking	Structures Monitoring	III.A2.TP-25	3.5.1-54	A

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**
Concrete (accessible areas): interior and above-grade exterior	EN, FLB, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28	3.5.1-67	A
Concrete (accessible areas): below-grade exterior; foundation	EN, FLB, MB, SNS, SRE, SSR	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-27	3.5.1-65	A
Concrete (accessible areas): interior and above-grade exterior	EN, FLB, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking	Structures Monitoring	III.A2.TP-25	3.5.1-54	A
Concrete (inaccessible areas): below-grade exterior; foundation	EN, FLB, MB, SNS, SRE, SSR	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-29	3.5.1-67	A
Concrete (inaccessible areas): below-grade exterior; foundation	EN, FLB, MB, SNS, SRE, SSR	Concrete	Soil	Cracking	Structures Monitoring	III.A2.TP-204	3.5.1-43	E

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**
Concrete (accessible areas): exterior above- and below-grade; foundation	EN, FLB, MB, SNS, SRE, SSR	Concrete	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-23	3.5.1-64	A
Concrete (accessible areas): exterior above- and below-grade; foundation	EN, FLB, MB, SNS, SRE, SSR	Concrete	Air – outdoor	Cracking	Structures Monitoring	III.A2.TP-25	3.5.1-54	A
Drywell floor slab	SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-26	3.5.1-66	A
Drywell floor slab	SSR	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28	3.5.1-67	A
Drywell floor slab	SSR	Concrete	Air – indoor uncontrolled	Cracking	Structures Monitoring	III.A2.TP-25	3.5.1-54	A
Masonry walls	EN, PB SNS, SSR	Concrete block	Air – indoor uncontrolled	Cracking	Masonry Wall	III.A2.T-12	3.5.1-70	A

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
Masonry walls	FB	Concrete block	Air – indoor uncontrolled	Cracking	Fire Protection Structures Monitoring	VII.G.A-90	3.3.1-60	E
Reactor pedestal	SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-26	3.5.1-66	A
Reactor pedestal	SSR	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28	3.5.1-67	A
Reactor pedestal	SSR	Concrete	Air – indoor uncontrolled	Cracking	Structures Monitoring	III.A2.TP-25	3.5.1-54	A
Shield plugs	EN, SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-26	3.5.1-66	A
Shield plugs	EN, SSR	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28	3.5.1-67	A

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**
Steam tunnel	MB, PB, SNS, SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, loss of material	Structures Monitoring	III.A2.TP-26	3.5.1-66	A
Steam tunnel	MB, PB, SNS, SSR	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28	3.5.1-67	A
Steam tunnel	MB, PB, SNS, SSR	Concrete	Air – indoor uncontrolled/ Soil	Cracking	Structures Monitoring	III.A2.TP-25	3.5.1-54	A
Compressible seals for drywell personnel access airlock, equipment hatch, CRD hatch, equipment hatch, torus manway covers	PB, SSR	Elastomer	Air – indoor uncontrolled	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
Moisture barrier	EN, SSR	Elastomer	Air – indoor uncontrolled	Loss of sealing	CII-IWE	II.B4.CP-40	3.5.1-26	A

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
Primary containment electrical penetration seals and sealant	PB, SSR	Elastomer	Air – indoor uncontrolled	Loss of sealing	Containment Leak Rate	II.B4.CP-41	3.5.1-33	A
Service Level I coatings	SNS	Coatings	Air – indoor uncontrolled	Loss of coating integrity	Protective Coating Monitoring and Maintenance	II.B4.CP-152	3.5.1-34	A
Service Level I coatings	SNS	Coatings	Air – indoor uncontrolled	Loss of coating integrity	Protective Coating Monitoring and Maintenance	III.A4.TP-301	3.5.1-73	A
Service Level I coatings	SNS	Coatings	Exposed to fluid environment	Loss of coating integrity	Protective Coating Monitoring and Maintenance			G
Spent fuel storage pool gates rubber gasket/seal	EN, SSR	Elastomer	Exposed to fluid environment	Loss of sealing	Periodic Surveillance and Preventive Maintenance	III.A6.TP-7	3.5.1-72	E
Spent fuel storage pool gates rubber gasket/seal	EN, SSR	Elastomer	Air – indoor uncontrolled	Loss of sealing	Periodic Surveillance and Preventive Maintenance	II.B4.CP-40	3.5.1-26	E

Table 3.5.2-2
Water-Control Structures
Summary of Aging Management Evaluation

Table 3.5.2-2: Water-Control Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Fire protection fuel-oil storage tank support	SRE	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302	3.5.1-77	A
Steel components: beams, columns, plates	EN, HS, SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	C
Steel components: beams, columns, plates	EN, HS, SRE, SNS, SSR	Carbon steel	Air – outdoor	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	C
Steel components: monorails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	C
Steel sheet piles for shore barrier	FLB, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Steel sheet piles for shore barrier	FLB, SSR	Carbon steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A3.TP-219	3.5.1-79	A
Steel sheet piles for shore barrier	FLB, SSR	Carbon steel	Soil	None	None			I, 502
Beams, columns and floor slabs	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	RG 1.127	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-2: Water-Control Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Concrete (accessible areas): all	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	RG 1.127	III.A6.TP-38	3.5.1-59	A
Concrete (accessible areas): all	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – outdoor/ Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	RG 1.127	III.A6.TP-38	3.5.1-59	A
Concrete (accessible areas): all	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Exposed to fluid environment	Increase in porosity and permeability; Loss of strength	RG 1.127	III.A6.TP-37	3.5.1-61	A
Concrete (inaccessible areas): all	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
Concrete (inaccessible areas): all	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – outdoor/ Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
Concrete (inaccessible areas): all	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled/ Air – outdoor/ Soil/ Exposed to fluid environment	Cracking	RG 1.127	III.A6.TP-220	3.5.1-50	E

Table 3.5.2-2: Water-Control Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Concrete (inaccessible areas): all	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A6.TP-107	3.5.1-67	A
Concrete (accessible areas): exterior above- and below-grade; foundation; interior slab	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Exposed to fluid environment	Increase in porosity and permeability; Loss of strength	RG 1.127	III.A6.TP-37	3.5.1-61	A
Concrete (accessible areas): exterior above- and below-grade; foundation	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Exposed to fluid environment	Loss of material	RG 1.127	III.A6.T-20	3.5.1-56	A
Concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Exposed to fluid environment	Increase in porosity and permeability; Loss of strength	RG 1.127	III.A6.TP-109	3.5.1-51	A

Table 3.5.2-2: Water-Control Structures

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Exposed to fluid environment	Cracking	RG 1.127	III.A6.TP-220	3.5.1-50	E
Concrete (accessible areas): exterior above- and below-grade; foundation	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – outdoor	Cracking, loss of material	RG 1.127	III.A6.TP-36	3.5.1-60	A
Concrete (inaccessible areas): exterior above- and below-grade; foundation	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – outdoor	Cracking, loss of material	RG 1.127	III.A6.TP-110	3.5.1-49	A
Concrete (inaccessible areas): exterior above- and below-grade; foundation	EN, FLB, HS, MB, SNS, SRE, SSR	Concrete	Air – outdoor	Cracking	RG 1.127	III.A6.TP-220	3.5.1-50	E
Exterior concrete roof slabs	EN, MB, SRE, SSR	Concrete	Air – indoor uncontrolled/ Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	RG 1.127	III.A6.TP-38	3.5.1-59	A

Table 3.5.2-2: Water-Control Structures

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Masonry walls	EN, MB, SNS, SSR	Concrete block	Air – indoor uncontrolled	Cracking	Masonry Wall	III.A6.T-12	3.5.1-70	A
Masonry walls	FB	Concrete block	Air – indoor uncontrolled	Cracking	Structures Monitoring Fire Protection	VII.G.A-90	3.3.1-60	C
Masonry walls	FB	Concrete block	Air – indoor uncontrolled	Loss of material	Structures Monitoring Fire Protection	VII.G.A-91	3.3.1-62	C
RHR cooling tower fill/mist eliminators	SSR	Asbestos cement board	Exposed to fluid environment	Loss of material	RG 1.127			J
Barrier stone	FLB, SSR	Rock/stone	Air – outdoor/ Exposed to fluid environment	Loss of material; Loss of form	RG 1.127	III.A6.T-22	3.5.1-58	A

**Table 3.5.2-3
Turbine Building, Process Facilities and Yard Structures
Summary of Aging Management Evaluation**

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Cranes: rails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Inspection of OVHLL	VII.B.A-07	3.3.1-52	A
Cranes: structural girders	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Inspection of OVHLL	VII.B.A-07	3.3.1-52	A
Metal siding	EN, SNS	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Monorails	SNS	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Pressure relief or blowout panels	PR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Roof decking or floor decking	EN, PR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Roof decking or floor decking	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	VII.G.AP-150	3.3.1-58	C
Steel missile barrier	MB	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Structural steel: beams, columns, plates	EN, MB, SNS, SRE	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A3.TP-302	3.5.1-77	A
Sump liners	SNS, SRE	Stainless steel	Exposed to fluid environment	Loss of material	Structures Monitoring	III.A7.T-23	3.5.1-52	E
Transmission towers, angle tower, pull-off tower	SRE	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	C
Beams, columns and floor slabs	EN, SNS, SRE	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
Beams, columns and floor slabs	EN, SNS, SRE	Concrete	Air – indoor uncontrolled	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
Concrete (accessible areas): interior and above-grade exterior	EN, FLB, MB, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
Concrete (accessible areas): interior and above-grade exterior	EN, FLB, MB, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-28	3.5.1-67	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Concrete (accessible areas): interior and above-grade exterior	EN, FLB, MB, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
Concrete (accessible areas): below-grade exterior; foundation	EN, FLB, MB, SNS, SRE	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-27	3.5.1-65	A
Concrete (inaccessible areas): below-grade exterior; foundation	EN, FLB, MB, SNS, SRE	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
Concrete (inaccessible areas): below-grade exterior; foundation	EN, FLB, MB, SNS, SRE	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-29	3.5.1-67	A
Concrete (inaccessible areas): below-grade exterior; foundation	EN, FLB, MB, SNS, SRE	Concrete	Soil	Cracking	Structures Monitoring	III.A3.TP-204	3.5.1-43	E

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Concrete (accessible areas): exterior above- and below-grade; foundation	EN, FLB, MB, SNS, SRE	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A3.TP-23	3.5.1-64	A
Concrete (accessible areas): exterior above- and below-grade; foundation	EN, FLB, MB, SNS, SRE	Concrete	Air – outdoor	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
Cable tunnel	SRE	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
Cable tunnel	SRE	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
Cable tunnel	SRE	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-28	3.5.1-67	A

Table 3.5.2-3: *Turbine Building, Process Facilities and Yard Structures*								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Cable tunnel	SRE	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-29	3.5.1-67	A
Cable tunnel	SRE	Concrete	Soil	Cracks and distortion	Structures Monitoring	III.A3.TP-30	3.5.1-44	A
Cable tunnel	SRE	Concrete	Air – indoor uncontrolled/ Soil	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
CST/CRT retaining barrier	EN, SNS	Concrete	Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
CST/CRT retaining barrier	EN, SNS	Concrete	Soil	Cracks and distortion	Structures Monitoring	III.A3.TP-30	3.5.1-44	A
CST/CRT retaining barrier	EN, SNS	Concrete	Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A7.TP-28	3.5.1-67	A
CST/CRT retaining barrier	EN, SNS	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A7.TP-23	3.5.1-64	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
CST/CRT retaining barrier	EN, SNS	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
CST/CRT retaining barrier	EN, SNS	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-29	3.5.1-67	A
CST/CRT retaining barrier	EN, SNS	Concrete	Air – outdoor/ Soil	Cracking	Structures Monitoring	III.A7.TP-25	3.5.1-54	A
CST/CRT retaining barrier	FB	Concrete	Air – outdoor	Cracking, loss of material	Fire Protection Structures Monitoring	VII.G.A-92	3.3.1-61	A
Duct banks	EN, SNS, SRE, SSR	Concrete	Soil	Cracks and distortion	Structures Monitoring	III.A3.TP-30	3.5.1-44	A
Duct banks	EN, SNS, SRE, SSR	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Duct banks	EN, SNS, SRE, SSR	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-29	3.5.1-67	A
Duct banks	EN, SNS, SRE, SSR	Concrete	Soil	Cracking	Structures Monitoring	III.A3.TP-204	3.5.1-43	E
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	SNS, SRE, SSR	Concrete	Soil	Cracks and distortion	Structures Monitoring	III.A3.TP-30	3.5.1-44	A
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	SNS, SRE, SSR	Concrete	Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	SNS,SRE, SSR	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	SNS, SRE, SSR	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-29	3.5.1-67	A
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	SNS, SRE, SSR	Concrete	Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	SNS, SRE, SSR	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A3.TP-23	3.5.1-64	A
Foundations (e.g., switchyard, transformers, tanks, circuit breakers, CTG, CTG-FOST)	SNS, SRE, SSR	Concrete	Air – outdoor/ Soil	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
ISFSI rail transfer pad	MB, SSR	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A3.TP-23	3.5.1-64	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
ISFSI rail transfer pad	MB, SSR	Concrete	Air – outdoor/ Soil	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
Manholes and handholes	EN, SNS, SRE, SSR	Concrete	Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
Manholes and handholes	EN, SNS, SRE, SSR	Concrete	Soil	Cracks and distortion	Structures Monitoring	III.A3.TP-30	3.5.1-44	A
Manholes and handholes	EN, SNS, SRE, SSR	Concrete	Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
Manholes and handholes	EN, SNS, SRE, SSR	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A3.TP-23	3.5.1-64	A
Manholes and handholes	EN, SNS, SRE, SSR	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A
Manholes and handholes	EN, SNS, SRE, SSR	Concrete	Air – outdoor/ Soil	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Manholes and handholes	EN, SNS, SRE, SSR	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-29	3.5.1-67	A
Manholes and handholes	FB	Concrete	Air – outdoor	Cracking and loss of material	Structures Monitoring Fire Protection	VII.G.A-92	3.3.1-61	C
Manholes and handholes	FB	Concrete	Air – outdoor	Loss of material	Structures Monitoring Fire Protection	VII.G.A-93	3.3.1-62	C
Masonry walls	EN, SNS, SRE	Concrete block	Air – outdoor	Loss of material (spalling, scaling) and cracking	Masonry Wall	III.A5.TP-34	3.5.1-71	A
Masonry walls	EN, SRE	Concrete block	Air – indoor uncontrolled or Air – outdoor	Cracking	Masonry Wall	III.A3.T-12	3.5.1-70	A
Masonry walls	FB	Concrete block	Air – indoor uncontrolled or Air – outdoor	Cracking	Fire Protection Structures Monitoring	VII.G.A-90	3.3.1-60	C
Masonry walls	FB	Concrete block	Air – indoor uncontrolled	Loss of material	Fire Protection Structures Monitoring	VII.G.A-91	3.3.1-62	C

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Pipe tunnel	EN, MB, SRE	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
Pipe tunnel	EN, MB, SRE	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
Pipe tunnel	EN, MB, SRE	Concrete	Air – indoor uncontrolled/ Soil	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
Pipe tunnel	EN, MB, SRE	Concrete	Air – indoor uncontrolled	Reduction of strength and modulus	Structures Monitoring	III.A3.TP-114	3.5.1-48	E
Pipe tunnel	EN, MB, SRE	Concrete	Soil	Cracks and distortion	Structures Monitoring	III.A3.TP-30	3.5.1-44	A
Pipe tunnel	EN, MB, SRE	Concrete	Soil	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-212	3.5.1-65	A

Table 3.5.2-3: Turbine Building, Process Facilities and Yard Structures								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Pipe tunnel	EN, MB, SRE	Concrete	Soil	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-29	3.5.1-67	A
Roof slabs	EN, MB, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A
Roof slabs	EN, MB, SNS, SRE	Concrete	Air – outdoor or Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
Roof slabs	EN, MB, SNS, SRE	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A3.TP-23	3.5.1-64	A
Roof slabs	EN, MB, SNS, SRE	Concrete	Air – outdoor/ Air – indoor uncontrolled	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A

Table 3.5.2-4
Bulk Commodities
Summary of Aging Management Evaluation

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Anchorage/ embedments	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302 III.A4.TP-302	3.5.1-77	C
Anchorage/ embedments	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C
Anchorage/ embedments	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	ISI-IWF	III.B1.1.T-24 III.B1.2.T-24	3.5.1-91	C
Anchorage/ embedments	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Exposed to fluid environment	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	C
Anchorage / embedments	SNS, SRE, SSR	Stainless steel	Exposed to fluid environment	Loss of material	Water Chemistry Control – BWR ISI-IWF	III.B1.1.TP-10	3.5.1-90	C
Cable tray	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C
Cable tray	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2.TP-8	3.5.1-95	C

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Cable tray	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	C
Conduit	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C
Conduit	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2.TP-8	3.5.1-95	C
Conduit	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	C
Constant and variable load spring hangers; guides; stops (Supports for ASME Class 1, 2 and 3 piping and components)	SRE, SSR	Carbon steel, Galvanized steel	Air – indoor uncontrolled	Loss of mechanical function	ISI-IWF	III.B1.1.T-28 III.B1.2.T-28 III.B1.3.T-28	3.5.1-57	A
Doors	EN, FLB, PB, MB	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302 III.A4.TP-302	3.5.1-77	C
Doors	EN, FLB, PB, MB	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A6.TP-248	3.5.1-80	C
Doors	EN, FLB, PB, MB	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302	3.5.1-77	C
Fire doors	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Fire doors	SRE	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302 III.A4.TP-302	3.5.1-77	C
Fire hose reels	SRE	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Fire Water System	III.B2.TP-43	3.5.1-92	E
Fire protection components – miscellaneous steel including framing steel	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	C
Manways, hatches, manhole covers and hatch covers	EN, FLB, PB, MB, SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302 III.A4.TP-302	3.5.1-77	C
Mirror insulation	IN, SNS	Stainless steel	Air – indoor uncontrolled	None	None	VII.J.AP-17	3.3.1-120	C
Missile shields	EN, MB	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A7.TP-302	3.5.1-77	C

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Miscellaneous steel (decking, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.)	EN, FLB, SNS, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302 III.A4.TP-302	3.5.1-77	C
Miscellaneous steel (decking, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.)	EN, FLB, SNS, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A6.TP-248	3.5.1-80	C
Miscellaneous steel (decking, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.)	EN, FLB, SNS, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2.TP-8 III.B5.TP-8	3.5.1-95	C

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Miscellaneous steel (decking, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.)	EN, FLB, SNS, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302 III.A4.TP-302	3.5.1-77	C
Miscellaneous steel (decking, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.)	EN, FLB, SNS, SSR	Aluminum	Air – indoor uncontrolled	None	None	III.B2.TP-8 III.B5.TP-8	3.5.1-95	C
Miscellaneous steel (decking, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.)	EN, FLB, SNS, SSR	Aluminum	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	C
Penetration seals (end caps)	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	C
Penetration seals (end caps)	EN, FLB, PB, SNS, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-302 III.A3.TP-302 III.A4.TP-302	3.5.1-77	C

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Penetration sleeves (mechanical/ electrical not penetrating primary containment boundary)	FB	Carbon steel	Air – indoor uncontrolled	Loss of material	Fire Protection	VII.G.A-21	3.3.1-59	C
Penetration sleeves (mechanical/ electrical not penetrating primary containment boundary)	EN, FLB, PB, SNS, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C
Racks, panels, cabinets and enclosures for electrical equipment and instrumentation	EN, SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	C
Racks, panels, cabinets and enclosures for electrical equipment and instrumentation	EN, SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B3.TP-8	3.5.1-95	C

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Racks, panels, cabinets and enclosures for electrical equipment and instrumentation	EN, SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B3.TP-43	3.5.1-92	C
Racks, panels, cabinets and enclosures for electrical equipment and instrumentation	EN, SNS, SRE, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B3.TP-8	3.5.1-95	C
Racks, panels, cabinets and enclosures for electrical equipment and instrumentation	EN, SNS, SRE, SSR	Stainless steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6 III.B4.TP-6	3.5.1-93	C
Tube track	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-43	3.5.1-92	C
Tube track	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2.TP-8	3.5.1-95	C
Tube track	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6	3.5.1-93	C

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Support members; welds; bolted connections; support anchorage to building structure	SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	ISI-IWF	III.B1.1.T-24 III.B1.2.T-24	3.5.1-91	A
Support members; welds; bolted connections; support anchorage to building structure	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled or Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-43 III.B3.TP-43 III.B4.TP-43 III.B5.TP-43	3.5.1-92	A
Support members; welds; bolted connections; support anchorage to building structure	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B1.1.TP-8 III.B1.2.TP-8 III.B2.TP-8 III.B3.TP-8 III.B4.TP-8 III.B5.TP-8	3.5.1-95	A
Support members; welds; bolted connections; support anchorage to building structure	SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	ISI-IWF	III.B1.1.T-24 III.B1.2.T-24	3.5.1-91	A
Support members; welds; bolted connections; support anchorage to building structure	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6 III.B4.TP-6	3.5.1-93	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Support members; welds; bolted connections; support anchorage to building structure	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.B3.TP-43 III.B5.TP-43	3.5.1-92	A
Support members; welds; bolted connections; support anchorage to building structure	SNS, SRE, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B2.TP-8 III.B3.TP-8	3.5.1-95	A
Support members; welds; bolted connections; support anchorage to building structure	SNS, SRE, SSR	Stainless steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6 III.B4.TP-6	3.5.1-93	A
Anchor bolts	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-248 III.A3.TP-248 III.A4.TP-248 III.A5.TP-248 III.A6.TP-248	3.5.1-80	A
Anchor bolts	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-274 III.A3.TP-274 III.A4.TP-274 III.A5.TP-274	3.5.1-82	A
Anchor bolts	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Anchor bolts	SNS, SRE, SSR	Carbon steel	Exposed to fluid environment	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A
Anchor bolts	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B2.TP-8	3.5.1-95	C
Anchor bolts	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-274 III.A3.TP-274 III.A4.TP-274 III.A5.TP-274	3.5.1-82	A
Anchor bolts	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A
Anchor bolts	SNS, SRE, SSR	Galvanized steel	Exposed to fluid environment	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A
Anchor bolts	SNS, SRE, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B2.TP-8	3.5.1-95	C
Anchor bolts	SNS, SRE, SSR	Stainless steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6 III.B4.TP-6	3.5.1-93	C
Anchor bolts	SNS, SRE, SSR	Stainless steel	Exposed to fluid environment	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A
High strength structural bolting (Supports for ASME Class 1, 2, 3, and MC piping and components)	SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1.TP-226 III.B1.2.TP-226 III.B1.3.TP-226	3.5.1-81	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
High strength structural bolting (Supports for ASME Class 1, 2, 3, and MC piping and components)	SRE, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B1.1.TP-8 III.B1.2.TP-8 III.B1.3.TP-8	3.5.1-95	A
Structural bolting; Structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.)	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-248 III.A3.TP-248 III.A4.TP-248 III.A5.TP-248 III.A6.TP-248	3.5.1-80	A
Structural bolting; Structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.)	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-274 III.A3.TP-274 III.A4.TP-274	3.5.1-82	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Structural bolting; Structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.)	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A
Structural bolting; Structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.)	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B5.TP-8	3.5.1-95	C

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Structural bolting; Structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.)	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-274 III.A3.TP-274 III.A4.TP-274	3.5.1-82	A
Structural bolting; Structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.)	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Structural bolting	SNS, SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	Structures Monitoring	III.A2.TP-248 III.A3.TP-248 III.A4.TP-248 III.A5.TP-248 III.A6.TP-248 III.B2.TP-248 III.B3.TP-248 III.B4.TP-248 III.B5.TP-248	3.5.1-80	A
Structural bolting	SRE, SSR	Carbon steel	Air – indoor uncontrolled	Loss of material	ISI-IWF	III.B1.1.TP-226 III.B1.2.TP-226 III.B1.3.TP-226	3.5.1-81	A
Structural bolting	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-274 III.A3.TP-274 III.A4.TP-274 III.B2.TP-274 III.B3.TP-274 III.B4.TP-274 III.B5.TP-274	3.5.1-82	A
Structural bolting	SNS, SRE, SSR	Carbon steel	Air – outdoor	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A
Structural bolting	SRE, SSR	Carbon steel	Air – outdoor	Loss of material	ISI-IWF	III.B1.1.TP-235 III.B1.2.TP-235	3.5.1-86	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Structural bolting	SNS, SRE, SSR	Galvanized steel	Air – indoor uncontrolled	None	None	III.B1.1.TP-8 III.B1.2.TP-8 III.B1-3.TP-8 III.B2.TP-8 III.B3.TP-8 III.B4.TP-8 III.B5.TP-8	3.5.1-95	C
Structural bolting	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	Structures Monitoring	III.A2.TP-274 III.A3.TP-274 III.A4.TP-274 III.B2.TP-274 III.B3.TP-274 III.B4.TP-274 III.B5.TP-274	3.5.1-82	A
Structural bolting	SNS, SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	RG 1.127	III.A6.TP-221	3.5.1-83	A
Structural bolting	SRE, SSR	Galvanized steel	Air – outdoor	Loss of material	ISI-IWF	III.B1.1.TP-235 III.B1.2.TP-235	3.5.1-86	A
Structural bolting	SRE, SSR	Stainless steel	Air – indoor uncontrolled	None	None	III.B1.1.TP-8 III.B1.2.TP-8 III.B1-3.TP-8 III.B2.TP-8 III.B3.TP-8	3.5.1-95	C
Structural bolting	SNS, SRE, SSR	Stainless steel	Air – outdoor	Loss of material	Structures Monitoring	III.B2.TP-6 III.B4.TP-6	3.5.1-93	A
Structural bolting	SRE, SSR	Stainless steel	Air – outdoor	Loss of material	ISI-IWF	III.B2.TP-6	3.5.1-93	E

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Structural bolting	SNS, SRE, SSR	Carbon steel, Stainless steel, Galvanized steel	Air – indoor uncontrolled or Air – outdoor	Loss of preload	Structures Monitoring	III.A2.TP-261 III.A3.TP-261 III.A4.TP-261 III.A5.TP-261 III.A6.TP-261 III.B2.TP-261 III.B3.TP-261 III.B4.TP-261 III.B5.TP-261	3.5.1-88	A
Structural bolting	SNS, SRE, SSR	Carbon steel, Stainless steel, Galvanized steel	Air – indoor uncontrolled or Air – outdoor	Loss of preload	ISI-IWF	III.B1.1.TP-229 III.B1.2.TP-229 III.B1.3.TP-229	3.5.1-87	A
Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	SNS, SSR, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Reduction in concrete anchor capacity	Structures Monitoring	III.B1.1.TP-42 III.B1.2.TP-42 III.B1.3.TP-42 III.B2.TP-42 III.B3.TP-42 III.B4.TP-42 III.B5.TP-42	3.5.1-55	A
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-26 III.A3.TP-26 III.A4.TP-26 III.A5.TP-26	3.5.1-66	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	RG 1.127	III.A6.TP-38	3.5.1-59	A
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28 III.A3.TP-28 III.A4.TP-28 III.A5.TP-28	3.5.1-67	A
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A2.TP-23 III.A3.TP-23 III.A5.TP-23	3.5.1-64	A
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	RG 1.127	III.A6.TP-36	3.5.1-60	A
Equipment pads/ foundations	SNS, SRE, SSR	Concrete	Air – indoor uncontrolled/ Air – outdoor/ Soil	Cracking	Structures Monitoring	III.A2.TP-25 III.A3.TP-25 III.A4.TP-25 III.A5.TP-25	3.5.1-54	A
Curbs	FLB, SNS, SRE	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-26	3.5.1-66	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Curbs	FLB, SNS, SRE	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A3.TP-28	3.5.1-67	A
Curbs	FLB, SNS, SRE	Concrete	Air – indoor uncontrolled	Cracking	Structures Monitoring	III.A3.TP-25	3.5.1-54	A
Manways, hatches/ plugs, manhole covers and hatch covers	FLB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-26 III.A3.TP-26 III.A4.TP-26 III.A5.TP-26	3.5.1-66	A
Manways, hatches/ plugs, manhole covers and hatch covers	FLB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A
Manways, hatches/ plugs, manhole covers and hatch covers	FLB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled or Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28 III.A3.TP-28 III.A4.TP-28 III.A5.TP-28 III.A6.TP-107	3.5.1-67	A
Manways, hatches/ plugs, manhole covers and hatch covers	FLB, PB, SNS, SRE, SSR	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A3.TP-23	3.5.1-64	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Manways, hatches/ plugs, manhole covers and hatch covers	FLB, PB, SNS, SRE, SSR	Concrete	Air – indoor uncontrolled/ Air – outdoor	Cracking	Structures Monitoring	III.A2.TP-25 III.A3.TP-25 III.A4.TP-25 III.A5.TP-25	3.5.1-54	A
Manways, hatches/ plugs, manhole covers and hatch covers	FB	Concrete	Air – indoor uncontrolled	Loss of material	Fire Protection Structures Monitoring	VII.G.A-91	3.3.1-62	A
Manways, hatches/ plugs, manhole covers and hatch covers	FB	Concrete	Air – indoor uncontrolled	Cracking	Fire Protection Structures Monitoring	VII.G.A-90	3.3.1-60	A
Manways, hatches/ plugs, manhole covers and hatch covers	FB	Concrete	Air – outdoor	Cracking, loss of material	Fire Protection Structures Monitoring	VII.G.A-92	3.3.1-61	A
Manways, hatches/ plugs, manhole covers and hatch covers	FB	Concrete	Air – outdoor	Loss of material	Fire Protection Structures Monitoring	VII.G.A-93	3.3.1-62	A
Missile shields	MB	Concrete	Air – indoor uncontrolled	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A7.TP-26	3.5.1-66	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Missile shields	MB	Concrete	Air – indoor uncontrolled	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A7.TP-28	3.5.1-67	A
Missile shields	MB	Concrete	Air – indoor uncontrolled	Cracking	Structures Monitoring	III.A7.TP-25	3.5.1-54	A
Structural fire barriers; walls, ceilings, floor slabs	FB	Concrete	Air – indoor uncontrolled	Cracking	Fire Protection Structures Monitoring	VII.G.A-90	3.3.1-60	A
Structural fire barriers; walls, ceilings, floor slabs	FB	Concrete	Air – indoor uncontrolled	Loss of material	Fire Protection Structures Monitoring	VII.G.A-91	3.3.1-62	A
Structural fire barriers; walls, ceilings, floor slabs	FB	Concrete	Air – outdoor	Cracking, loss of material	Fire Protection Structures Monitoring	VII.G.A-92	3.3.1-61	A
Support pedestals	SSR, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-26 III.A3.TP-26 III.A4.TP-26 III.A5.TP-26	3.5.1-66	A
Support pedestals	SSR, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking, loss of bond, and loss of material (spalling, scaling)	Structures Monitoring	III.A6.TP-104	3.5.1-65	A

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Support pedestals	SSR, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring	III.A2.TP-28 III.A3.TP-28 III.A4.TP-28 III.A5.TP-28 III.A6.TP-107	3.5.1-67	A
Support pedestals	SSR, SNS, SRE	Concrete	Air – outdoor	Loss of material (spalling, scaling) and cracking	Structures Monitoring	III.A3.TP-23	3.5.1-64	A
Support pedestals	SSR, SNS, SRE	Concrete	Air – indoor uncontrolled or Air – outdoor	Cracking	Structures Monitoring	III.A2.TP-25 III.A3.TP-25 III.A4.TP-25 III.A5.TP-25	3.5.1-54	A
Compressible joints and seals	SNS, SSR	Elastomers	Air – indoor uncontrolled or Air – outdoor	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
Compressible joints and seals	SNS, SSR	Elastomers	Exposed to fluid environment	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
Fire stops	FB	Carborundum durablanket, carborundum fibersil cloth, fiberboard, silicone elastomers	Air – indoor uncontrolled	Loss of material, Change in material properties, Cracking/ delamination, separation	Fire Protection			J

Table 3.5.2-4: Bulk Commodities

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Fire wrap	FB	Carborundum durablanket, carborundum fibersil cloth, Thermo-lag, elastomers	Air – indoor uncontrolled	Loss of material, Change in material properties, Cracking/ delamination, separation	Fire Protection			J
Insulation (includes jacketing, wire mesh, tie wires, straps, clips)	IN, SNS	Fiberglass, calcium silicate, Fiberfrax, fiberfrax ceramic fiber durablanket, Insulfrax	Air – indoor uncontrolled	Loss of material, Change in material properties	Structures Monitoring			J
Insulation (includes jacketing, wire mesh, tie wires, straps, clips)	IN, SNS	Aluminum	Air – indoor uncontrolled	None	None	VII.J.AP-36	3.3.1-113	C
Insulation (includes jacketing, wire mesh, tie wires, straps, clips)	IN, SNS	Stainless steel	Air – indoor uncontrolled	None	None	VII.J.AP-17	3.3.1-120	C
Penetration seals	FB	Elastomers	Air – indoor uncontrolled	Increased hardness, shrinkage, loss of strength	Fire Protection	VII G.A-19	3.3.1-57	A

Table 3.5.2-4: Bulk Commodities								
Structure and/or Component or Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Penetration seals	EN, FLB, PB, SNS	Elastomers	Air – indoor uncontrolled or Air – outdoor	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
Roof membranes	EN, SNS	Elastomers	Air – outdoor	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	C
Seals and gaskets (doors, manways and hatches)	FLB, PB, SSR	Elastomers	Air – indoor uncontrolled or Air – outdoor	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	A
Seismic/expansion joint	SSR	Elastomers	Air – outdoor	Loss of sealing	Structures Monitoring	III.A6.TP-7	3.5.1-72	C
Vibration isolators	SNS, SSR	Elastomers	Air – indoor uncontrolled	Reduction or loss of isolation function	Structures Monitoring	III.B4.TP-44	3.5.1-94	E

3.6 ELECTRICAL AND INSTRUMENTATION AND CONTROLS

3.6.1 Introduction

This section provides the results of the aging management review for Fermi 2 electrical components that were subject to aging management review. Consistent with the methods described in NEI 95-10, the electrical and I&C aging management reviews focus on commodity groups rather than systems. The following electrical commodity groups requiring aging management review are addressed in this section.

- High-voltage insulators
- Non-EQ insulated cables and connections
  - Cable connections (metallic parts)
  - Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
  - Electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits
  - Electrical and I&C penetration cables and connections not subject to 10 CFR 50.49 EQ requirements
  - Fuse holders (insulation material)
  - Non-EQ fuse holder (metallic portion)
  - Inaccessible power (400 V to 13.8 kV) cables (e.g., installed underground in conduit, duct bank or direct buried) not subject to 10 CFR 50.49 EQ requirements
- Metal-enclosed bus
- Switchyard bus and connections
- Transmission conductors and connections

Table 3.6.1, Summary of Aging Management Programs for Electrical Components Evaluated in Chapter VI of NUREG-1801, provides the summary of the aging management reviews and the programs evaluated in NUREG-1801 for the electrical and I&C components. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

3.6.2 Results

Table 3.6.2, Electrical and I&C Components—Summary of Aging Management Evaluation, summarizes the results of aging management reviews and the NUREG-1801 comparison for electrical and I&C components.

3.6.2.1 Materials, Environments, Aging Effects Requiring Management, and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for electrical and I&C components subject to aging management review. Programs are described in Appendix B. Further details are provided in Table 3.6.2.

Materials

Electrical and I&C components subject to aging management review are constructed of the following materials.

- Aluminum
- Copper
- Cement
- Elastomers
- Galvanized metals
- Insulation material – various organic polymers
- Insulation material – paper and oil
- Porcelain
- Steel and steel alloys
- Various metals used for electrical bus and connections

Environments

Electrical and I&C components subject to aging management review are exposed to the following environments.

- Air – indoor controlled
- Air – indoor uncontrolled
- Air – outdoor
- Heat, moisture, or radiation and air
- Significant moisture

Aging Effects Requiring Management

The following aging effects associated with electrical and I&C components require management.

- Change in material properties
- Increased resistance of connection
- Loss of material
- Reduced insulation resistance (IR)

Aging Management Programs

The following aging management programs will manage the effects of aging on electrical and I&C components.

- Metal Enclosed Bus Inspection
- Non-EQ Cable Connections

- Non-EQ Inaccessible Power Cables (400 V to 13.8 kV)
- Non-EQ Instrumentation Circuits Test Review
- Non-EQ Insulated Cables and Connections

3.6.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues. Section 3.6.2.2 of NUREG-1800 discusses these aging effects and other issues that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain the Fermi 2 approach to these areas requiring further evaluation. Programs are described in Appendix B of this application.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Electrical equipment environmental qualification (EQ) analyses may be TLAAs as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of EQ TLAAs are addressed in Section 4.4. EQ components are subject to replacement based on a qualified life. Therefore, in accordance with 10 CFR 54.21(a)(1)(ii), EQ components are not subject to aging management review.

3.6.2.2.2 Degradation of Insulator Quality due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear

The discussion in NUREG-1800 concerns effects of these aging mechanisms on high voltage insulators.

High voltage insulators are subject to aging management review if they are necessary for the alternate AC source for SBO, or recovery of offsite power following an SBO. Other high voltage insulators are not subject to aging management review since they do not perform a license renewal intended function.

The high voltage insulators evaluated for Fermi 2 license renewal are those used to support uninsulated, high-voltage electrical components such as transmission conductors and switchyard buses that are in the scope of license renewal.

Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas washed away by rain. The glazed insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover.

Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. Fermi 2 is not located near the seacoast or near other sources of airborne particles. Therefore, reduced insulation resistance due to surface contamination is not an applicable aging effect for high-voltage insulators at Fermi 2.

Loss of material due to mechanical wear is a potential aging effect for strain and suspension insulators subject to movement. Although this aging effect is possible, industry experience has shown transmission conductors do not normally swing and when subjected to a substantial wind, movement will subside after a short period. Wear has not been apparent during routine inspections and is not a credible aging effect.

There are no aging effects requiring management for Fermi 2 high-voltage insulators.

3.6.2.2.3 Loss of Material due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength due to Corrosion, and Increased Resistance of Connection due to Oxidation or Loss of Pre-load

Transmission conductors are uninsulated, stranded electrical cables used outside buildings in high voltage applications. The transmission conductor commodity group includes the associated fastening hardware but excludes the high-voltage insulators. Major active equipment assemblies include their associated transmission conductor terminations.

Transmission conductors are subject to aging management review if they are necessary for recovery of offsite power following an SBO. At Fermi 2, transmission conductors from the Fermi 2 345 kV switchyard to the transformer (SS 65) support recovery from an SBO. Other transmission conductors are not subject to aging management review since they do not perform a license renewal intended function.

Switchyard bus is uninsulated, unenclosed, rigid electrical conductors used in medium- and high-voltage applications. Switchyard bus includes the hardware used to secure the bus to high-voltage insulators. Switchyard bus establishes electrical connections to disconnect switches, switchyard breakers, and transformers.

Switchyard bus is subject to aging management review if it is necessary for recovery of offsite power following an SBO. At Fermi 2, switchyard bus from the 345 kV switchyard breakers to the 345 kV transmission conductors support recovery from an SBO. Other switchyard bus does not require aging management review since it does not perform a license renewal intended function.

Loss of Conductor Strength (Corrosion)

The aging effect loss of conductor strength (corrosion) applies to aluminum conductor steel reinforced (ACSR) transmission conductors. The most prevalent mechanism contributing to loss of conductor strength of an ACSR transmission conductor is corrosion, which includes corrosion of the steel core and aluminum strand pitting. For

ACSR transmission conductors, degradation begins as a loss of zinc from the galvanized steel core wires.

The Fermi 2 transmission conductors subject to aging management review are all aluminum conductor (AAC) construction, so the typical degradation of ACSR conductors is not applicable to Fermi 2.

The high-voltage side of Fermi 2 transformer SS 65 is connected to the 345 kV switchyard via overhead 2500 MCM [thousand circular mils] AAC transmission lines. These transmission lines are constructed of concentrically stranded conductors consisting of aluminum alloy wires in multi-layer construction. No organic materials are involved. AAC transmission conductors are similar in construction to aluminum-reinforced designed aluminum conductor alloy reinforced (ACAR) transmission conductors except that the AAC transmission conductors do not have an aluminum alloy core. The aluminum-reinforced design gives ACAR transmission conductors a higher strength rating; however, this is not needed for the short span of the 345-kV AAC transmission conductors in this application. AAC transmission conductors, unlike ACSR transmission conductors, have better corrosion resistant properties, so they are not susceptible to environmental influences, such as sulfur dioxide (SO_2) concentration in the air. When aluminum corrodes, it forms a protective oxide layer that protects the underlying material from further corrosion, unlike the steel core of an ACSR conductor which gradually loses its galvanized coating and will continually corrode, causing a decrease in ultimate strength. Therefore, the Fermi 2 transmission conductors are not susceptible to the same corrosion phenomenon as ACSR transmission conductors.

For the aging management review of ACSR transmission conductors, the Ontario Hydroelectric study is used to discuss the environment and aging effects. ACAR and AAC transmission conductors are not susceptible to the same corrosion phenomenon as ACSR transmission conductors, and this study supports that statement.

The Ontario Hydroelectric test did not include 2500 MCM AAC conductors. The Ontario Hydroelectric study reported,

> The aluminum layers were found to have retained their original properties to a large degree. On the other hand the steel strands showed reductions in both tensile strength and the number of turns to failure.

This is consistent with NUREG-1801 Item VI.A.LP-46 that states a program for ACAR transmission cables is not needed for loss of conductor strength due to corrosion, and no further evaluation is required. The AAC transmission conductors have the same corrosion resistant properties as the ACAR transmission conductors.

The Fermi 2 transmission conductors within the scope of this review are relatively short spans (approximately 325 ft.). Therefore, the tension exerted on the conductors in the 345 kV switchyard is less than would be experienced in typical transmission applications, which could be up to 1000 feet in length. The AAC transmission conductors do not experience a loss of conductor strength due to corrosion, so there is reasonable assurance that the Fermi 2 AAC transmission conductors will have ample strength through the period of extended operation.

A review of industry OE and NRC generic communications related to the aging of transmission conductors ensured that no additional aging effects exist beyond those identified. A review of plant-specific OE did not identify any unique aging effects for transmission conductors.

Therefore, loss of conductor strength is not an aging effect requiring management for Fermi 2 AAC transmission conductors.

Loss of Material (Wear)

Wind loading can cause transmission conductor vibration, or sway. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation. The 345 kV transmission lines and their associated structures, interconnecting the switchyard with the transmission system, are designed to withstand the loading conditions for environmental conditions prevalent in the area. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are not applicable aging effects in that they would not cause a loss of intended function if left unmanaged for the period of extended operation.

Operation of active switchyard components is also a potential contributor to vibration and resulting wear. Switchyard bus is connected to active equipment by short sections of flexible conductors. The flexible conductors withstand the minor vibrations associated with the active switchyard components. The flexible conductors are part of the switchyard bus commodity group. The rigid bus itself is supported by insulators and ultimately by static, structural components such as concrete footings and structural steel. Vibration issues typically occur early in plant life, because of inadequate design, installation, or maintenance. Vibration is not applicable to the rigid switchyard bus since flexible conductors connecting switchyard bus to active components eliminate potential for vibration.

A review of industry operating experience and NRC generic communications related to the aging of transmission conductors ensured that no additional aging effects exist beyond those previously identified. A review of plant-specific operating experience did not identify any unique aging effects for transmission conductors.

Therefore, loss of material due to wear of transmission conductors is not an aging effect requiring management at Fermi 2.

Therefore, loss of material due to wear of switchyard bus is not an aging effect requiring management at Fermi 2.

Increased Connection Resistance (Corrosion)

Corrosion due to surface oxidation for welded aluminum switchyard bus and connections is not applicable. However, the flexible conductors, which are welded to the switchyard bus, are bolted to the other switchyard components. These steel and steel alloy switchyard component connections are included in the infrared inspection of the 120 kV and 345 kV switchyard connections, which verifies the effectiveness of the connection design and installation practices. Fermi 2 performs infrared inspection of the 120 kV and 345 kV switchyard connections as part of a repetitive preventive maintenance (PM) task to verify the integrity of the connections on a quarterly basis. This inspection and the absence of plant specific OE verifies that this aging effect is not significant for Fermi 2.

Corrosion is a very slow acting aging mechanism, and the corrosion rates depend largely on air quality, which includes suspended particles chemistry, SO_2 concentration in air, precipitation, fog chemistry and meteorological conditions. Air quality in rural areas generally contains low concentrations of suspended particles and SO_2, which keeps the corrosion rate to a minimum. There are no major industries in the immediate rural area where Fermi 2 is located. Fermi 2 is located on the western shore of Lake Erie in Monroe County, Michigan. The plant is approximately 8 miles east-northeast of Monroe, Michigan; 28 miles southwest of downtown Detroit, Michigan; and 26 miles northeast of downtown Toledo, Ohio. Consequently, air quality is not considered a significant contributor to this aging mechanism.

Increased connection resistance due to surface oxidation is a potential aging effect but is not significant enough to cause a loss of intended function. The aluminum, steel, and steel alloy components in the switchyard are exposed to precipitation, but these components do not experience aging effects in this environment, except for minor oxidation, which does not impact the ability of the connections to perform their intended function. At Fermi 2, switchyard connection surfaces are coated with an anti-oxidant compound (i.e., a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connections, thus minimizing the potential for corrosion. Based on operating experience (Fermi 2 and the industry), this method of installation provides a corrosion-resistant low electrical resistance connection. This discussion is applicable for bolted connections of transmission conductors and switchyard bus.

These switchyard component connections are included in the infrared inspection of the 345 kV and 120 kV switchyard and transformer yard connections, which verifies the effectiveness of the connection design and installation practices. Fermi 2 performs infrared inspection of the 345 kV and 120 kV switchyard connections and transformer yard connections as part of a periodic PM task to verify the integrity of the connections. This inspection and plant-specific operating experience verifies that this aging effect is not significant for Fermi 2.

Therefore, increased connection resistance due to general corrosion resulting from oxidation of switchyard connection metal surfaces is not an aging effect requiring management at Fermi 2.

Increased Connection Resistance (Loss of Preload)

Increased connection resistance due to loss of pre-load (torque relaxation) for switchyard connections is not an aging effect requiring management. The Electric Power Research Institute (EPRI) license renewal tools do not list loss of pre-load as an applicable aging mechanism. The design of the transmission conductor and switchyard bus bolted connections precludes torque relaxation as confirmed by plant-specific operating experience. The review of Fermi 2 operating experience did not identify any failures of switchyard connections. The design of switchyard bolted connections includes Belleville washers and an antioxidant compound (i.e., a grease-type sealant) to preclude connection degradation. The type of bolting plate and the use of Belleville washers is the industry standard to preclude torque relaxation. This combined with the proper sizing of the conductors eliminates this aging mechanism; therefore, increased connection resistance due to loss of pre-load on switchyard connections is not an aging effect requiring management. Transmission conductor and switchyard bus bolted connections use stainless steel (Alloy 304) bolts, nuts and washers including Belleville washers. This discussion is applicable for bolted connections of transmission conductors and switchyard bus.

In-scope transmission conductors and switchyard bus at Fermi 2 are limited to the connections from the 345 kV switchyard to the high-voltage side of transformer SS 65 used for recovery of off-site power following a SBO. Fermi 2 performs infrared inspection of the 345 kV switchyard connections as part of a repetitive PM task to verify the integrity of the connections on a quarterly basis. This inspection and the absence of plant-specific operating experience verifies that this aging effect is not significant for Fermi 2.

Routine inspections of the Fermi 2 345 kV and 120 kV switchyard and transformer yards includes performing infrared inspection of the 345 kV and 120 kV switchyard connections and the transformer yard as part of a periodic PM task to verify the integrity of the connections. These routine inspections, as confirmed by plant-specific operating experience, confirm that this aging effect is not significant for Fermi 2.

Based on this information, increased connection resistance due to loss of pre-load of transmission conductor and switchyard bus connections is not an aging effect requiring management for Fermi 2.

There are no applicable aging effects that could cause loss of the intended function of the transmission conductors for the period of extended operation.

There are no aging effects requiring management for Fermi 2 transmission conductors and switchyard bus connections.

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of Fermi 2 quality assurance procedures and administrative controls for aging management programs.

3.6.2.2.5 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of Fermi 2 operating experience review programs.

3.6.2.3 Time-Limited Aging Analysis

The only TLAAs identified for the electrical and I&C commodity components are evaluations for environmental qualification (EQ) associated with 10 CFR 50.49. The EQ TLAAs are evaluated in Section 4.4.

3.6.3 Conclusion

Electrical and I&C components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). Aging management programs selected to manage aging effects for the electrical and I&C components are identified in Section 3.6.2.1 and in the following tables. A description of aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Based on the demonstrations provided in Appendix B, the effects of aging associated with electrical and I&C components will be managed such that there is reasonable assurance the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.6.1
Summary of Aging Management Programs for the Electrical and I&C Components Evaluated in Chapter VI of NUREG-1801

Table 3.6.1: Electrical Components					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-1	Electrical equipment subject to 10 CFR 50.49 EQ requirements composed of various polymeric and metallic materials exposed to adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage	Various aging effects due to various mechanisms in accordance with 10CFR 50.49	EQ is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA	EQ equipment is not subject to aging management review because the equipment is subject to replacement based on a qualified life. EQ analyses are evaluated as potential TLAAs in Section 4.4. See Section 3.6.2.2.1 for further evaluation.

Table 3.6.1: Electrical Components

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-2	High-voltage insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air – outdoor	Loss of material due to mechanical wear caused by wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated	Yes, plant specific	NUREG-1801 aging effects are not applicable to Fermi 2. See Section 3.6.2.2.2 for further evaluation.
3.6.1-3	High-voltage insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air – outdoor	Reduced insulation resistance due to presence of salt deposits or surface contamination	A plant-specific aging management program is to be evaluated for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution)	Yes, plant specific	NUREG-1801 aging effects are not applicable to Fermi 2. See Section 3.6.2.2.2 for further evaluation.
3.6.1-4	Transmission conductors composed of aluminum; steel exposed to air – outdoor	Loss of conductor strength due to corrosion	A plant-specific aging management program is to be evaluated for ACSR	Yes, plant specific	Consistent with NUREG-1801. An AMP is not required to manage loss of conductor strength due to corrosion for AAC transmission conductors. See Section 3.6.2.2.3 for further evaluation.

Table 3.6.1: Electrical Components					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-5	Transmission connectors composed of aluminum; steel exposed to air – outdoor	Increased resistance of connection due to oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated	Yes, plant specific	NUREG-1801 aging effects are not applicable to Fermi 2. See Section 3.6.2.2.3 for further evaluation.
3.6.1-6	Switchyard bus and connections composed of aluminum; copper; bronze; stainless steel; galvanized steel exposed to air – outdoor	Loss of material due to wind-induced abrasion; Increased resistance of connection due to oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated	Yes, plant specific	NUREG-1801 aging effects are not applicable to Fermi 2. See Section 3.6.2.2.3 for further evaluation.
3.6.1-7	Transmission conductors composed of aluminum; steel exposed to air – outdoor	Loss of material due to wind-induced abrasion	A plant-specific aging management program is to be evaluated for ACAR and ACSR	Yes, plant specific	NUREG-1801 aging effects are not applicable to Fermi 2. See Section 3.6.2.2.3 for further evaluation.

Table 3.6.1: Electrical Components					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-8	Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by heat, radiation, or moisture	Reduced insulation resistance due to thermal/ thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Chapter XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Consistent with NUREG-1801. The Non-EQ Insulated Cables and Connections Program will manage the effects of aging. This program includes inspection of non-EQ electrical and I&C penetration cables and connections. Fermi 2 EQ electrical and I&C penetration assemblies are covered under the Environmental Qualification (EQ) of Electric Components Program.

Table 3.6.1: Electrical Components					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-9	Insulation material for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by heat, radiation, or moisture	Reduced insulation resistance due to thermal/ thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Chapter XI.E2, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits"	No	Consistent with NUREG-1801. The Non-EQ Instrumentation Circuits Test Review Program will manage the effects of aging. This program includes review of calibration results or surveillance findings for instrumentation circuits.

Table 3.6.1: Electrical Components					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-10	Conductor insulation for inaccessible power cables greater than or equal to 400 volts (e.g., installed in conduit or direct buried) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by significant moisture	Reduced insulation resistance due to moisture	Chapter XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Consistent with NUREG-1801. The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program will manage the effects of aging. This program includes inspection and testing of power cables exposed to significant moisture as required.
3.6.1-11	Metal enclosed bus: enclosure assemblies composed of elastomers exposed to air – indoor, controlled or uncontrolled or air – outdoor	Surface cracking, crazing, scuffing, dimensional change (e.g. "ballooning" and "necking"), shrinkage, discoloration, hardening and loss of strength due to elastomer degradation	Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. The Metal Enclosed Bus Inspection Program will manage the effects of aging. This program includes elastomers associated with flexible boots.

Table 3.6.1: Electrical Components					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-12	Metal enclosed bus: bus/connections composed of various metals used for electrical bus and connections exposed to air – indoor, controlled or uncontrolled or air – outdoor	Increased resistance of connection due to the loosening of bolts caused by thermal cycling and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	Consistent with NUREG-1801. The Metal Enclosed Bus Inspection Program will manage the effects of aging. This program includes visual inspection of interior portions of the bus.
3.6.1-13	Metal enclosed bus: insulation; insulators composed of porcelain; xenoy; thermo-plastic organic polymers exposed to air – indoor, controlled or uncontrolled or air – outdoor	Reduced insulation resistance due to thermal/ thermoxidative degradation of organics/ thermoplastics, radiation-induced oxidation, moisture/debris intrusion, and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	Consistent with NUREG-1801. The Metal Enclosed Bus Inspection Program will manage the effects of aging. This program includes visual inspection of interior portions of the bus.
3.6.1-14	Metal enclosed bus: external surface of enclosure assemblies composed of steel exposed to air – indoor, uncontrolled or air – outdoor	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Metal Enclosed Bus Inspection Program will manage the effects of aging. This program includes visual inspection of exterior portions of the bus.

Table 3.6.1: Electrical Components					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-15	Metal enclosed bus: external surface of enclosure assemblies composed of galvanized steel; aluminum exposed to air – outdoor	Loss of material due to pitting and crevice corrosion	Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring"	No	Consistent with NUREG-1801. The Metal Enclosed Bus Inspection Program will manage the effects of aging. This program includes visual inspection of exterior portions of the bus.
3.6.1-16	Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, uncontrolled	Increased resistance of connection due to chemical contamination, corrosion, and oxidation (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply); fatigue due to ohmic heating, thermal cycling, electrical transients	Chapter XI.E5, "Fuse Holders"	No	NUREG-1801 aging effects are not applicable to Fermi 2. A review of Fermi 2 documentation showed that fuse holders utilizing metallic clamps located in circuits that perform an intended function, and are not part of an active device, do not have aging effects that require management. Therefore, fuse holders with metallic clamps at Fermi 2 do not have aging effects that require an aging management program.

Table 3.6.1: Electrical Components

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-17	Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, controlled or uncontrolled	Increased resistance of connection due to fatigue caused by frequent manipulation or vibration	Chapter XI.E5, "Fuse Holders" No aging management program is required for those applicants who can demonstrate these fuse holders are located in an environment that does not subject them to environmental aging mechanisms or fatigue caused by frequent manipulation or vibration	No	NUREG-1801 aging effects are not applicable to Fermi 2. A review of Fermi 2 documentation showed that fuse holders utilizing metallic clamps located in circuits that perform an intended function, and are not part of an active device, do not have aging effects that require management. Therefore, fuse holders with metallic clamps at Fermi 2 do not have aging effects that require an aging management program.
3.6.1-18	Cable connections (metallic parts) composed of various metals used for electrical contacts exposed to air – indoor, controlled or uncontrolled or air – outdoor	Increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Chapter XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Consistent with NUREG-1801. The Non-EQ Cable Connections Program consists of a one-time inspection to verify the absence of aging effects requiring management.
3.6.1-19	PWR only				

Table 3.6.1: Electrical Components

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-20	Transmission conductors composed of aluminum exposed to air – outdoor	Loss of conductor strength due to corrosion	None - for Aluminum Conductor Aluminum Alloy Reinforced (ACAR)	None	NUREG-1801 aging effects are not applicable to Fermi 2. See Section 3.6.2.2.3 for further evaluation.
3.6.1-21	Fuse holders (not part of active equipment): insulation material, metal enclosed bus: external surface of enclosure assemblies composed of insulation material: bakelite; phenolic melamine or ceramic; molded polycarbonate; other, galvanized steel; aluminum, steel exposed to air – indoor, controlled or uncontrolled	None	None	NA – No AEM or AMP	Consistent with NUREG-1801.

Notes for Tables 3.6.2

Generic notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

601. The NUREG-1801, Revision 2, program XI.E5 for fuse holders is not applicable to Fermi 2 EIC components. The fuse holders in the Division I and Division II 230/130 VDC fuse cabinets (R3200S007A & 7B and R3200S008A & 8B) are subject to aging management review. The fuses in these panels were evaluated for aging effects (increased connection resistance) that could require management. Increased connection resistance of the metallic portions of the non-EQ fuse holders is caused by mechanical fatigue due to frequent manipulation by plant personnel, and vibration, or thermal fatigue due to ohmic heating, thermal cycling, or electrical transients. In addition, increased connection resistance of the metallic portions of the non-EQ fuse holders is caused by chemical contamination, corrosion, and oxidation; however, in an air – indoor controlled environment, increased connection resistance due to chemical contamination, corrosion and oxidation is not applicable. The 230/130 VDC

fuse cabinets are located in a controlled environment (air – indoor controlled); therefore, the fuse holders in these cabinets do not have aging effects (increased connection resistance of the metallic portions of the non-EQ fuse holders) caused by chemical contamination, corrosion, and oxidation, so no aging management program is needed for these stressors. In addition, the evaluation of the fuses in the 230/130 VDC fuse cabinets determined that the aging effects due to thermal fatigue in the form of high resistance caused by ohmic heating, thermal cycling, electrical transients, or mechanical fatigue caused by frequent manipulation (removal/replacement of the fuse), or vibration do not require aging management. Based on the aging management review, these fuse holders do not have aging effects that require an aging management program.

Table 3.6.2
Electrical Components
Summary of Aging Management

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**
Cable connections (metallic parts)	CE	Various metals used for electrical connections	Air – indoor controlled or uncontrolled or Air – outdoor	Increased resistance of connection	Non-EQ Cable Connections	VI.A.LP-30 VI.A-1 (LP-12)	3.6.1-18	A
Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) not subject to 10 CFR 50.49 EQ requirements (includes non-EQ electrical and I&C penetration conductors and connections)	IN	Insulation material – various organic polymers	Heat, moisture, or radiation and air	Reduced insulation resistance (IR)	Non-EQ Insulated Cables and Connections	VI.A.LP-33 VI.A-2 (L-01)	3.6.1-8	A

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**
Insulation material for electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits	IN	Insulation material – various organic polymers	Heat, moisture, or radiation and air	Reduced insulation resistance (IR)	Non-EQ Instrumentation Circuits Test Review	VI.A.LP-34 VI.A-3 (L-02)	3.6.1-9	A
Fuse holders (not part of active equipment): insulation material	IN	Insulation material – various organic polymers	Air – indoor controlled or uncontrolled	None	None	VI.A.LP-24 VI.A-7 (LP-02)	3.6.1-21	A
Fuse holders (not part of active equipment): metallic clamps	CE	Various metals used for electrical connections	Air – indoor controlled or uncontrolled	None	None	VI.A.LP-31 VI.A-8 (LP-01)	3.6.1-17	I, 601
Fuse holders (not part of active equipment): metallic clamps	CE	Various metals used for electrical connections	Air – indoor controlled or uncontrolled	None	None	VI.A.LP-23 VI.A-8 (LP-01)	3.6.1-16	I, 601
High voltage insulators (high voltage insulators for SBO recovery)	IN	Porcelain, galvanized metal, cement	Air – outdoor	None	None	VI.A.LP-32 VI.A-10 (LP-11)	3.6.1-2	I

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 recovery)	IN	Porcelain, galvanized metal, cement	Air – outdoor	None	None	VI.A.LP-28 VI.A-9 (LP-07)	3.6.1-3	I
Conductor insulation for inaccessible power cables (400 V to 13.8 kV) not subject to 10 CFR 50.49 EQ requirements	IN	Insulation material – various organic polymers; paper and oil	Significant moisture	Reduced insulation resistance (IR)	Non-EQ Inaccessible Power Cables (400 V to 13.8 kV)	VI.A.LP-35 VI.A-4 (L-03)	3.6.1-10	A
Metal enclosed bus: bus/connections	CE	Various metals used for electrical bus and connections	Air – indoor, controlled or uncontrolled or Air – outdoor	Increased resistance of connection	Metal Enclosed Bus Inspection	VI.A.LP-25	3.6.1-12	A
Metal enclosed bus: enclosure assemblies	CE	Elastomers	Air – indoor, controlled or uncontrolled or Air – outdoor	Change in material properties	Metal Enclosed Bus Inspection	VI.A.LP-29	3.6.1-11	A
Metal enclosed bus: external surface of enclosure assemblies	CE	Galvanized steel; aluminum	Air – indoor, controlled or uncontrolled	None	None	VI.A.LP-41	3.6.1-21	A
Metal enclosed bus: external surface of enclosure assemblies	CE	Galvanized steel; aluminum	Air – outdoor	Loss of material	Metal Enclosed Bus Inspection	VI.A.LP-42	3.6.1-15	A

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
Metal enclosed bus: external surface of enclosure assemblies	CE	Steel	Air – indoor, controlled	None	None	VI.A.LP-44	3.6.1-21	A
Metal enclosed bus: external surface of enclosure assemblies	CE	Steel	Air – indoor, uncontrolled or Air – outdoor	Loss of material	Metal Enclosed Bus Inspection	VI.A.LP-43	3.6.1-14	A
Metal enclosed bus: insulation; insulators	IN	Porcelain; insulation material – various organic polymers	Air – indoor, controlled or uncontrolled or Air – outdoor	Reduced insulation resistance (IR)	Metal Enclosed Bus Inspection	VI.A.LP-26	3.6.1-13	A
Switchyard bus and connections (switchyard bus for 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
Transmission conductors (transmission conductors for SBO recovery)	CE	Aluminum	Air – outdoor	None	None	VI.A.LP-46 VI.A-16 (LP-08)	3.6.1-4	C

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
Transmission conductors (transmission conductors for SBO recovery)	CE	Aluminum	Air – outdoor	None	None	VI.A.LP-47 VI.A-16 (LP-08)	3.6.1-7	I
Transmission connectors (transmission connectors for SBO recovery)	CE	Aluminum, steel, steel alloy	Air – outdoor	None	None	VI.A.LP-48 VI.A-16 (LP-08)	3.6.1-5	I

4.0 TIME-LIMITED AGING ANALYSES

This section provides the results of the evaluation of each identified time-limited aging analysis (TLAA) and exemptions in accordance with 10 CFR 54.21(c).

Section 4.1 provides the 10 CFR 54 definition and requirements for TLAAs and a review of the process used for identifying and evaluating TLAAs and exemptions for Fermi 2.

Subsequent sections describe the evaluation of TLAAs within the following categories.

- Section 4.2, Reactor Vessel Neutron Embrittlement
- Section 4.3, Metal Fatigue
- Section 4.4, Environmental Qualification (EQ) of Electric Equipment
- Section 4.5, Concrete Containment Tendon Prestress
- Section 4.6, Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analysis
- Section 4.7, Other Plant-Specific TLAAs

References for Section 4 are provided in Section 4.8.

4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

Time-limited aging analyses are defined in 10 CFR 54.3.

> *Time-limited aging analyses*, for the purposes of this part, are those licensee calculations and analyses that:
>
> (1) Involve systems, structures, and components within the scope of license renewal, as delineated in §54.4(a);
>
> (2) Consider the effects of aging;
>
> (3) Involve time-limited assumptions defined by the current operating term, for example, 40 years;
>
> (4) Were determined to be relevant by the licensee in making a safety determination;
>
> (5) Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in §54.4(b); and
>
> (6) Are contained or incorporated by reference in the CLB [current licensing basis].

A list of TLAAs is required by 10 CFR 54.21(c) in an application for a renewed license, and 10 CFR 54.21(c)(2) requires a list of exemptions to 10 CFR 50 based on TLAA in the application for a renewed license.

> §54.21 Contents of application — technical information.
>
> (c) An evaluation of time-limited aging analyses.
>
> (1) A list of time-limited aging analyses, as defined in §54.3, must be provided. The applicant shall demonstrate that—
>
> (i) The analyses remain valid for the period of extended operation;
>
> (ii) The analyses have been projected to the end of the period of extended operation; or
>
> (iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.
>
> (2) A list must be provided of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on time-limited aging analyses as defined in §54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation.

4.1.1 Identification of TLAAs

The process used to identify TLAAs is consistent with the guidance provided in NEI 95-10 (Ref. 4-1). Calculations and analyses that potentially meet the definition of 10 CFR 54.3 were identified by searching CLB documents including the following.

- Updated Final Safety Analysis Report (UFSAR)
- Technical Specifications, Technical Requirements Manual and Bases
- Measurement Uncertainty Recapture License Amendment Request (LAR)
- BWRVIP documents referenced in the UFSAR or in docketed licensing correspondence
- Industry topical reports (relevant documents referenced in the UFSAR or in docketed licensing correspondence)
- Fire Protection Program documents
- Inservice Inspection Program documents
- NRC safety evaluation reports (SERs)
- Docketed licensing correspondence

Industry documents that list generic TLAAs were also reviewed to provide additional assurance of the completeness of the plant-specific list. These documents included NEI 95-10 (Ref. 4-1); NUREG-1800 (Ref. 4-2); NUREG-1801 (Ref. 4-3); and EPRI Report TR-105090 (Ref. 4-4).

Table 4.1-1 provides a summary listing of the TLAAs applicable to Fermi 2. Table 4.1-2 identifies the TLAAs listed in NUREG-1800 that are applicable to Fermi 2.

4.1.2 Identification of Exemptions

The search for exemptions for Fermi 2 was accomplished through a review of the UFSAR, ASME Section XI Program documentation, fire protection documents, the operating license, the Technical Specifications, and docketed correspondence. No exemptions that will remain in effect for the period of extended operation are based on a TLAA.

Table 4.1-1
List of Fermi 2 TLAAs and Resolution

TLAA Description	Resolution Option	LRA Section
Reactor Vessel Neutron Embrittlement Analyses		4.2
Reactor vessel fluence calculation	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.1
Adjusted reference temperatures	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.2
Pressure-temperature limits	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.2.3
Upper-shelf energy	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.4
Reactor vessel circumferential weld inspection relief	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.2.5
Reactor vessel axial weld failure probability	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.6
Reactor pressure vessel core reflood thermal shock analysis	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.2.7
Metal Fatigue Analyses		4.3
Class 1 fatigue analyses		4.3.1
Reactor pressure vessel	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.1
Reactor pressure vessel feedwater (FW) nozzles	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.2
Reactor pressure vessel underclad cracking	Not a TLAA	4.3.1.3
Reactor pressure vessel internals	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.4
Reactor recirculation pumps	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.5
Class 1 piping	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.1.6

Table 4.1-1 (Continued)
List of Fermi 2 TLAAs and Resolution

TLAA Description	Resolution Option	LRA Section
Non-Class 1 fatigue analyses		4.3.2
Piping and in-line components	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.3.2.1
Components other than piping	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.3.2.2
Effects of reactor water environment on fatigue life	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.3.3
Environmental Qualification Analyses of Electrical Equipment	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.4
Concrete Containment Tendon Prestress Analyses	Not a TLAA. Fermi 2 containment design does not include tendons.	4.5
Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analyses		4.6
Primary containment	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.6.1
Vent line bellows	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.6.2
Refueling and drywell seal bellows	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.6.3
Traversing incore probe penetration bellows	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.6.4
Containment penetrations	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.6.5
Other Plant-Specific TLAAs		4.7
Erosion of the main steam line flow restrictors	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.7.1
Determination of high energy line break locations	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.7.2
Jet pump auxiliary spring wedge assembly	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.7.3

Table 4.1-1 (Continued)
List of Fermi 2 TLAAs and Resolution

TLAA Description	Resolution Option	LRA Section
Jet pump slip joint repair clamps	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.7.4
Flaw evaluations for the reactor pressure vessel	Analysis projected 10 CFR 54.21(c)(1)(ii)	4.7.5
Main steam bypass lines cumulative operating time	Aging effects managed 10 CFR 54.21(c)(1)(iii)	4.7.6
Crane (heavy load) cycles	Analyses remain valid 10 CFR 54.21(c)(1)(i)	4.7.7

Table 4.1-2
Comparison of Fermi 2 TLAAs to NUREG-1800 TLAAs

NUREG-1800 TLAA Description	Applicable to Fermi 2 (Yes/No)	LRA Section
NUREG-1800 Table 4.1-2		
Reactor vessel neutron embrittlement	Yes	4.2
Metal fatigue	Yes	4.3
Environmental qualification of electrical equipment	Yes	4.4
Concrete containment tendon prestress	No. Fermi 2 containment design does not include tendons.	N/A
Inservice local metal containment corrosion analyses	No. Review of Fermi 2 records revealed no TLAA associated with containment corrosion.	N/A
NUREG-1800 Table 4.1-3		
Intergranular separation in the heat-affected zone of reactor vessel low-alloy steel under austenitic stainless steel (SS) cladding.	No. Review of Fermi 2 records revealed no TLAA associated with RPV intergranular separation.	4.3.1.3
Low-temperature overpressure protection analyses	No. Low-temperature overpressure protection is not applicable to BWRs.	N/A
Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps	No. Fermi 2 is a BWR that does not have an auxiliary feedwater pump.	N/A
Fatigue analysis of the reactor coolant pump flywheel	No. Fermi 2 is a BWR and the reactor recirculation pumps do not have flywheels.	N/A
Fatigue analysis of polar crane	Yes	4.7.7
Flow-induced vibration endurance limit for the reactor vessel internals	No. Evaluations are not based on the current operating term such as 40 years and are therefore not TLAA.	N/A
Transient cycle count assumptions for the reactor vessel internals	Yes	4.3.1.4
Ductility reduction of fracture toughness for the reactor vessel internals	No. Review of the Fermi 2 records did not identify any TLAA for reduction of fracture toughness for the reactor vessel internals.	N/A

Table 4.1-2 (Continued)
Comparison of Fermi 2 TLAAs to NUREG-1800 TLAAs

NUREG-1800 TLAA Description	Applicable to Fermi 2 (Yes/No)	LRA Section
Leak before break	No. Fermi 2 does not credit leak before break.	N/A
Fatigue analysis for the containment liner plate	Yes	4.6.1
Containment penetration pressurization cycles	Yes	4.6.5
Metal corrosion allowance	No. Corrosion allowances for metallic components were reviewed and no TLAA was identified.	N/A
High-energy line-break postulation based on fatigue cumulative factor	Yes	4.7.2
Inservice flaw growth analyses that demonstrate structure stability for 40 years	Yes	4.7.5

4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The regulations governing reactor vessel integrity are in 10 CFR 50. Section 50.60 requires that light-water reactors meet the fracture toughness, pressure-temperature limits, and material surveillance program requirements for the reactor coolant pressure boundary set forth in Appendices G and H of 10 CFR 50 (Ref. 4-6, 4-7).

The Fermi 2 period of extended operation begins on March 21, 2025, and ends on March 20, 2045. The effective full-power years (EFPY) is projected to be no more than 30.36 at the end of the current operating license term assuming a 100 percent capacity factor for cycles 15 through 24. Based on operation during the period of extended operation at a 100 percent capacity factor with no refueling outages, the EFPY would be less than 51 (30.36 + 20 = 50.36) at the end of the period of extended operation. A value of 52 EFPY is used to evaluate reactor vessel neutron embrittlement TLAAs to bound the maximum EFPY possible at the end of the period of extended operation.

DTE Electric has calculated fluence and adjusted reference temperature (ART), upper shelf energy (USE), pressure-temperature (P-T) limits, and probability of failure of circumferential welds of the reactor pressure vessel (RPV) beltline materials based on fluence expected at the end of the period of extended operation, including the increased fluence due to the measurement uncertainty recapture/thermal power optimization (MUR/TPO) uprate.

4.2.1 Reactor Vessel Fluence

Fluence is calculated based on a time-limited assumption defined by the operating term. Therefore, analyses that evaluate reactor vessel neutron embrittlement based on calculated fluence are TLAAs.

The reactor vessel fluence is calculated using a higher power level beginning with cycle 17, when the reactor power increased due to the MUR/TPO uprate. The peak neutron fluence projected for 52 EFPY is 1.43E+18 n/cm^2 at the vessel inner surface. The high energy (> 1 MeV) neutron fluence for the welds and shells of the RPV beltline region was determined using the General Electric-Hitachi (GEH) method for neutron flux calculation documented in report NEDC-32983P-A. The method adheres to the guidance prescribed in Regulatory Guide (RG) 1.190.
Table 4.2-1 shows results of the fluence evaluation.

The neutron fluence calculation results are inputs into fracture toughness TLAAs. The effects of aging due to neutron irradiation are considered in the neutron embrittlement TLAAs for the reactor vessel (e.g., upper-shelf energy analysis and P-T limits analysis). The neutron fluence analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

The RPV is shown in UFSAR Figure 5.4-1. It is a vertical, cylindrical pressure vessel with hemispherical heads of welded construction. The reactor vessel beltline is defined by 10 CFR 50 Appendix G as the region of the RPV that directly surrounds the effective height of the active core and adjacent regions of the RPV that are predicted to experience sufficient neutron irradiation damage to be considered in the selection of the most limiting material with regard to radiation damage. This region of the RPV consists of shell material, including welds, heat affected zones, and plates or forgings. Regulations of 10 CFR 50 Appendix H do not require material surveillance testing for reactor vessels unless the neutron fluence at the end of the design life exceeds 1E+17 n/cm^2. The beltline is thus considered to include the RPV ferritic materials with an end-of-life fluence that exceeds 1E+17 n/cm^2. The elevation range at which the projected fluence exceeds 1E+17 n/cm^2 for 52 EFPY was determined to be 9.83 inches below and 162.01 inches above the bottom of the active fuel. The beltline region for 52 EFPY includes plates and welds in shell rings 1 and 2 and the N16 nozzles for water level instrumentation. The peak fluence for the N16 nozzles for water level instrumentation is 3.57E+17 n/cm^2, exceeding the 1E+17 n/cm^2 fluence at 52 EFPY.

Table 4.2-1
Fermi 2 Beltline Fluence for 52 EFPY

Parameter	52-EFPY Fluence (n/cm^2)
Lower-Intermediate Shell Plates, Axial Welds Thickness = 6.125 inches	Peak I.D. fluence = 1.43E+18 n/cm^2 Peak ¼T fluence = 9.90E+17 n/cm^2
Water Level Instrumentation Nozzle Thickness = 6.125 inches	Peak I.D. fluence = 3.57E+17 n/cm^2 Peak ¼T fluence = 2.47E+17 n/cm^2
Lower Shell Plates and Axial Welds and Lower to Lower-Intermediate Girth Weld Thickness = 7.125 inches	Peak I.D. fluence = 9.99E+17 n/cm^2 Peak ¼T fluence = 6.51E+17 n/cm^2

4.2.2 Adjusted Reference Temperatures (ARTs)

A key parameter that characterizes the fracture toughness of a material is the reference nil-ductility transition temperature (RT_{NDT}) determined in accordance with the 1998 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code including 2000 Addenda, Section III, paragraph NB-2331. The RT_{NDT} increases with increasing neutron irradiation of the material. The effects of neutron radiation on RT_{NDT} are reflected in the reference temperature change (ΔRT_{NDT}). The adjusted reference temperature (ART) is calculated by adding ΔRT_{NDT} to initial RT_{NDT} with an appropriate margin for uncertainties (ΔRT_{NDT} + RT_{NDT} + margin) as defined by RG 1.99, Revision 2 (Ref. 4-8).

The method used for evaluation of the 52 EFPY ART is the same method used by GEH for the MUR/TPO ART evaluation. Table 4.2-2 and Table 4.2-3 show the results of this evaluation. The ART values for all beltline materials are calculated using fluence values determined with an NRC-approved method that complies with RG 1.190 (Ref. 4-9). The Integrated Surveillance Program (ISP) plate and weld material was evaluated for 52 EFPY in accordance with RG 1.99 Position 2.1 (surveillance data available) shown on Table 4.2-3. All other locations are completed in accordance with RG 1.99 Position 1.1 (surveillance data not available).

The Fermi 2 reactor vessel N16 instrumentation nozzles are small diameter nozzles fabricated from SA-508 Class 1 (SA508-1) carbon steel material. The N16 instrument nozzle chemistry values were determined using generic data. The N16 instrument nozzles are not the limiting components for the 52 EFPY ART evaluation.

All projected values are well below the 200°F suggested in Section C.3 of RG 1.99 as an acceptable nominal value of ART for the end of life. The ART is utilized in the evaluation of the pressure-temperature limits (see Section 4.2.3).

The TLAA for adjusted reference temperatures has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). Formal revisions of affected analyses are completed as part of the established process for generation of updated P-T operating limits.

Table 4.2-2
Fermi 2 Beltline ART Values for 52 EFPY—Plant Specific Chemistries

Component	Heat or Heat/Lot	%Cu	%Ni	Chemistry Factor (CF)	Initial RT_{NDT} (°F)	¼ T Fluence (n/cm^2)	52 EFPY ΔRT_{NDT} (°F)	σ_i	σ_Δ	Margin (°F)	52 EFPY Shift (°F)	52 EFPY ART (°F)
Lower Shell Plates												
G3706-1	C4540-2	0.08	0.62	51	-10	6.51E+17	17	0	9	17	34	24
G3706-2	C4560-1	0.11	0.57	74	-10	6.51E+17	25	0	12	25	50	40
G3706-3	C4554-1	0.12	0.56	82	-10	6.51E+17	28	0	14	28	55	45
Lower Intermediate Shell Plates												
G3703-5	C4564-1	0.09	0.55	58	-10	9.90E+17	24	0	12	24	48	38
G3705-1	B8614-1	0.12	0.61	83	-20	9.90E+17	35	0	17	34	69	49
G3705-2	C4574-2	0.10	0.55	65	-16	9.90E+17	27	0	13	27	54	38
G3705-3	C4568-2	0.12	0.61	83	-12	9.90E+17	35	0	17	34	69	57
Lower Shell Axial Welds												
2-307 A, B, C	Tandem 13253, 12008 1092 Lot 3833	0.26	0.87	224	-44	6.51E+17	75	0	28	56	131	87
Lower-Intermediate Shell Axial Welds												
15-308 A, B, C, D	33A277, 124 Lot 3878	0.32	0.50	188.5	-50	9.90E+17	78	0	28	56	134	84
Lower to Lower-Intermediate Girth Weld												
1-313	10137, 0091 Lot 3999	0.23	1.00	236	-50	6.51E+17	79	0	28	56	135	85

Table 4.2-3
Fermi 2 Beltline ART Values for 52 EFPY—ISP

Component	¼ T Fluence (n/cm^2)	52 EFPY ART (°F)
BWRVIP-135 R2		
Plate[a]	9.90E+17	57
Weld	6.51E+17	102

a. The results shown are for the representative ISP plate surveillance material.

4.2.3 Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires that the reactor vessel remain within established pressure-temperature (P-T) limits during boltup, hydro-test, pressure tests, normal operation, and anticipated operational occurrences. These limits are calculated using materials and fluence data, including data obtained through the Reactor Vessel Surveillance Program (Section B.1.38).

The N16 instrumentation nozzles are evaluated using the fluence at the nozzle and the limiting material properties.

The provisions of 10 CFR 50 Appendix G require Fermi 2 to operate within the licensed P-T limit curves. These curves are maintained and updated as necessary to maintain plant operation consistent with 10 CFR 50, Appendix G. The Fermi 2 P-T limit curves will be updated as necessary, including through the period of extended operation, in conjunction with the Reactor Vessel Surveillance Program (Section B.1.38).

Upjohn welds were used to fabricate selected longitudinal and all meridional seams in the Fermi 2 reactor vessel. The flaws in these welds are considered during the P-T limits evaluation.

The effects of aging associated with the P-T limits will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.4 Upper-Shelf Energy

Upper-shelf energy (USE) is evaluated for beltline materials. Fracture toughness criteria in 10 CFR 50 Appendix G require that beltline materials maintain USE no less than 50 ft-lb during operation of the reactor. The 52 EFPY USE values for the beltline materials were determined using methods consistent with RG 1.99. The determination used the peak ¼T fluence.

For the period of extended operation, Fermi 2 beltline materials were evaluated using RG 1.99 Revision 2. The calculations were based upon the peak ¼T fluence for 52 EFPY and, where appropriate, adjusted by a factor for the axial location. To assure that the weld materials meet all RG 1.99 requirements for USE, Position 2.2 was applied to all beltline weld materials. The results of this evaluation are shown in Table 4.2-4 and Table 4.2-5 and demonstrate that all beltline materials remain above 50 ft-lbs throughout the period of extended operation.

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

Table 4.2-4
Fermi 2 USE for 52 EFPY—Plant Specific

Location	Heat	Initial Longitudinal USE (ft-lb)	Initial Transverse USE(a) (ft-lb)	% Cu	52 EFPY ¼T Fluence (n/cm^2)	% Decrease USE(b)	52 EFPY USE(c) (ft-lb)
Lower Shell Plates							
G3706-1	C4540-2	145	94.3	0.08	6.51E+17	9	86
G3706-2	C4560-1	156	101.4	0.11	6.51E+17	11	90
G3706-3	C4554-1	132	85.8	0.12	6.51E+17	11.5	76
Lower-Intermediate Shell Plates							
G3703-5	C4564-1	115	74.8	0.09	9.90E+17	10.5	67
G3705-1	B8614-1	130	84.5	0.12	9.90E+17	12.5	74
G3705-2	C4574-2	120	78	0.10	9.90E+17	11.5	69
G3705-3	C4568-2	119	77.4	0.12	9.90E+17	12.5	68
Vertical Welds							
2-307 A, B, C	Tandem 13253, 12008 1092 Lot 3833	N/A	119	0.26	6.51E+17	21.5	93
2-307 A, B, C(d)	Tandem 13253, 12008 1092 Lot 3833	N/A	119	0.26	6.51E+17	35.5	77
15-308 A, B, C, D	33A277, 124 Lot 3878	N/A	94	0.32	9.90E+17	27.5	68
15-308 A, B, C, D(d)	33A277, 124 Lot 3878	N/A	94	0.32	9.90E+17	38.5	58
Girth Welds							
1-313	10137, 0091 Lot 3999	N/A	108	0.23	6.51E+17	20	86
1-313(d)	10137, 0091 Lot 3999	N/A	108	0.23	6.51E+17	33	72
Nozzles							
N16 (Water Level Instrumentation)	2127273 6397860				2.47E+17		52

a. Transverse USE for plate materials is determined using 65% of the longitudinal USE.
b. Values are obtained from Figure 2 of RG 1.99, Rev. 2, for the applicable 52 EFPY ¼T fluence.
c. 52 EFPY Transverse USE = Initial Transverse USE * {1 - (% Decrease USE / 100)}.
d. RG 1.99 Position 2.2 is applied to the weld materials, considering the measured decrease from the ISP.

Table 4.2-5
Fermi 2 USE for 52 EFPY—ISP

Location	52 EFPY ¼T Fluence (n/cm^2)	52 EFPY USE[(a)] (ft-lb)
BWRVIP-135 R2		
Plate[(b)]	9.90E+17	119
Weld[(c)]	6.51E+17	77

a. 52 EFPY Transverse USE = Initial Transverse USE * {1 - (% Decrease USE / 100)}.

b. The results shown are for the representative ISP plate surveillance material.

c. RG 1.99 Position 2.2 is applied to the weld materials, considering the measured decrease from the ISP.

4.2.5 Reactor Vessel Circumferential Weld Inspection Relief

The NRC granted relief request RR-A25, allowing elimination of the inspection of the reactor circumferential welds through the initial operating license term. The relief request is based on BWRVIP-05 and the guidance provided in Generic Letter (GL) 98-05. The analysis supporting relief from RPV circumferential weld examination is based on probabilistic assessments that predict an acceptably low probability of failure. The circumferential weld examination relief analysis involves a time-limited assumption defined by the current operating term, specifically the adjusted reference temperature of the reactor vessel beltline. The analysis is a TLAA.

Reevaluation of the circumferential weld inspection relief was included in the MUR/TPO submittal to evaluate the effects of the increased power out to 32 EFPY. The same method used in the MUR/TPO reanalysis was used to evaluate the acceptability of the relief through the period of extended operation (up to 52 EFPY.)

The SER for BWRVIP-05 states that licensees may request relief from the inservice inspection requirements of 10 CFR 50.55a(g) for volumetric examination of circumferential reactor vessel welds by demonstrating (1) at the expiration of the license, the circumferential welds satisfy the limiting conditional failure probability for circumferential welds in the SER and (2) the licensee has implemented operator training and established procedures that limit the frequency of cold over-pressure events to the amounts specified in the SER. Fermi 2 has procedures and Technical Specifications that monitor and control reactor pressure, temperature, and water inventory during all aspects of cold shutdown, minimizing the likelihood of a low-temperature over-pressurization (LTOP) event. Fermi 2 provides operator training on these procedures.

The reactor vessel for Fermi 2 was fabricated by Combustion Engineering. Table 4.2-6 provides the comparison of the mean adjusted reference temperature of the beltline circumferential welds to the Combustion Engineering reactor vessel evaluated in BWRVIP-05. Table 4.2-6 uses the 52 EFPY total surface (0T) fluence rather than ¼T fluence and no margin for RT_{NDT}, so the resulting change in RT_{NDT} is different from that shown in Table 4.2-2. The beltline circumferential weld material RT_{NDT} remains less than the acceptable RT_{NDT} specified in the SER for BWRVIP-74. As such, the conditional probability of failure for circumferential welds remains below that specified in the NRC's SER for BWRVIP-05.

Examinations of the axial welds, also called longitudinal welds, are completed in accordance with ASME code Section XI requirements. Examinations have not revealed an active mechanistic mode of degradation in the axial welds. In accordance with the BWRVIP-05 SER, examination of the circumferential welds will be performed if axial welds examinations reveal an active mechanistic mode of degradation.

A request for relief for the period of extended operation will be submitted to the NRC in accordance with 10 CFR 50.55(a).

The effects of aging associated with the reactor vessel circumferential weld inspection relief TLAA will be managed in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.2-6
Circumferential Weld Evaluation for 52 EFPY

Parameter	NRC Limiting Plant-Specific Analysis at 64 EFPY (Circ Welds)[a] (CE RPV)	NRC Limiting Plant-Specific Analysis at 64 EFPY (Circ Welds)[b] (CE RPV)	Parameters at Fermi 2 52 EFPY (CE RPV)
Weld copper content (%)	0.13	0.183	0.23
Weld nickel content (%)	0.71	0.704	1.00
Weld chemistry factor (CF)	151.7	172.2	236
Inside diameter neutron fluence at the end of the requested relief period (1E+19 n/cm^2)	0.40	0.40	0.0999
Initial reference temperature (RT_{NDT}) (°F)	0	0	-50
Increase in reference temperature without margin (ΔRT_{NDT}) (°F)[c]	113.2	128.5	98.3
Mean adjusted reference temperature (ART) (°F)	113.2	128.5	48.3
P (F/E) NRC[d]	1.99E-04	4.38E-04	(e)

a. Chemistry information reported in BWRVIP-05.

b. Chemistry information reported in CEOG report.

c. $\Delta RT_{NDT} = CF * f^{(0.28 - 0.10 \log f)}$

d. P (F/E) stands for "Probability of a failure event."

e. The mean ART values of reactor vessel circumferential welds govern the conditional probability of failure for the welds. Consistent with the provisions of GL 98-05, the Fermi analysis confirmed that the mean ART value of the circumferential welds is significantly less than the NRC-accepted mean ART value of the limiting-case circumferential welds for CE reactor vessels. Therefore, the conditional probability of failure for Fermi would be lower than the NRC-accepted value for CE reactor vessels.

4.2.6 Reactor Vessel Axial Weld Failure Probability

The NRC SER for BWRVIP-74-A evaluated the failure frequency of axially oriented welds in BWR reactor vessels. Applicants for license renewal must evaluate axially oriented RPV welds to show that their failure frequency remains below the value calculated in the BWRVIP-74 SER. The SER states that an acceptable way to do this is to show that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in the SER.

Table 4.2-7 compares the Fermi 2 reactor vessel limiting axial weld parameters to those used in the NRC analysis documented in BWRVIP-74. This table uses surface (0T) fluence rather than ¼T fluence and no margin for RT_{NDT}.

Table 4.2-7
Effects of Irradiation on Fermi 2 Reactor Vessel Axial Weld Properties

Parameter Description	**Fermi 2 Data for Weld Tandem 13253, 12008 1092 Lot 3833**
Neutron fluence, (*f*) 1E+19 n/cm^2	0.143
Weld copper content, %	0.26
Weld nickel content, %	0.87
Weld chemistry factor (CF)	224
Initial (unirradiated) reference temperature (RT_{NDT}), °F	-44
Increase in reference temperature (ΔRT_{NDT}), °F [$\Delta RT_{NDT} = CF \times f^{(0.28 - 0.10 \log f)}$]	110
Mean adjusted reference temperature (ART), °F ($RT_{NDT} + \Delta RT_{NDT}$)	66

The projected 52 EFPY Fermi 2 mean ART (66°F) is less than the bounding 114°F shown in the NRC SER for BWRVIP-74 (based on a calculation performed to identify the mean RT_{NDT} value required to provide a result which closely matches the RPV failure frequency of 5E-6 per reactor-year).

The reactor vessel axial weld TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.7 Reactor Pressure Vessel Core Reflood Thermal Shock Analysis

General Electric Report NEDO-10029 (Ref. 4-5) is referenced in UFSAR Section A.1.2 and Table 1.6-1. NEDO-10029 addressed the concern for brittle fracture of the RPV due to reflood following a postulated loss of coolant accident (LOCA). The thermal shock analysis documented in NEDO-10029 assumed a design basis recirculation line break LOCA followed by a low pressure coolant injection, accounting for the full effects of neutron embrittlement at the end of 40 years. This analysis bounded only 40 years of operation; therefore, reflood thermal shock of the RPV has been identified as a TLAA for Fermi 2 requiring evaluation for the period of extended operation.

A later analysis of the BWR vessels was developed by S. Ranganath in 1979 (Ref. 4-11). The Ranganath analysis is bounding for the Fermi 2 vessel. The thickness of the lower shell for the Fermi 2 vessel is 7.125 inches; the thickness of the lower-intermediate shell is 6.125 inches. The Ranganath analysis is bounding for Fermi 2 because (1) the pressure stress (higher for a thinner vessel) is near zero in a thermal shock event and therefore can be neglected, and (2) the difference in thermal stresses at the ¼T location between a 6-inch thick vessel and a 6.125-inch or 7.125-inch thick vessel (as demonstrated in Figure 4 of Ranganath) is small. The analysis shows that when the peak stress intensity occurs at approximately 300 seconds after the LOCA, the temperature of the vessel wall at 1.5 inches deep is approximately 400°F.

The maximum ART value calculated for the Fermi 2 RPV beltline material is 102°F. Using the equation for fracture toughness K_{IC} presented in Appendix A of ASME Section XI and the maximum ART value, the material reaches upper shelf at 206.25°F, which is well below the minimum 400°F temperature predicted for the thermal shock event at the time of peak stress intensity. Therefore, the revised analysis has projected the TLAA through the period of extended operation.

The RPV core reflood thermal shock TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.3 METAL FATIGUE

Fermi 2 fatigue analyses are TLAAs for Class 1 and non-Class 1 mechanical components. Fatigue is an age-related degradation mechanism caused by cyclic stressing of a component by either mechanical or thermal stresses.

Scoping and screening reviews identify mechanical components that are within the scope of license renewal and are subject to aging management review. When TLAA – metal fatigue is identified in the aging management program column of the tables in Section 3, the associated fatigue analyses are evaluated in this section. Evaluation of the TLAA, per 10 CFR 54.21(c)(1), determines whether

(i) the analyses remain valid for the period of extended operation,

(ii) the analyses have been projected to the end of the period of extend operation, or

(iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The evaluation of Fermi 2 Class 1 component fatigue analyses is documented in Section 4.3.1. Fatigue analysis of non-Class 1 mechanical components is discussed in Section 4.3.2. Evaluation of environmental fatigue effects (F_{en}) and environmentally adjusted cumulative usage factors (CUFs) is documented in Section 4.3.3.

4.3.1 Class 1 Fatigue Analyses

Fatigue evaluations were performed in the design of Class 1 components. Class 1 fatigue evaluations are contained in analyses and stress reports, and because they are based on a number of transient cycles assumed for a 40-year operating term, these evaluations are considered TLAA.

Based on the numbers of cycles accrued to date, the numbers of cycles at the end of 60 years of operation were projected as shown in Table 4.3-1. The projections are linear projections based of the rate of the occurrence from January 1, 2000, through December 31, 2012, except where identified by footnotes.

Fermi 2 recently reviewed the transient cycles that require counting and updated the cycle counts. These reviews provide the basis for the transient cycles that are listed in Table 4.3-1. The Fatigue Monitoring Program (Section B.1.17) tracks these transient cycles to manage the effects of fatigue for Class 1 components. The review included evaluation of transient cycle assumptions for locations that had been exempt from fatigue. The review identified one location that did not meet the fatigue exemption criteria when considering the projected cycles for 60 years. This has been identified in the Corrective Action Program, and further evaluation will reassess the exemption and calculate the fatigue usage for that location, if necessary.

The Fatigue Monitoring Program tracks transient cycles and requires corrective actions if the numbers of cycles approach analyzed values. The Fatigue Monitoring Program ensures that the numbers of transient cycles experienced by the plant remain within the allowable numbers of cycles. Appendix B, Section B.1.17, provides further details on the Fatigue Monitoring Program.

Table 4.3-1
Analyzed Transients with Projections

Event Number		Event Description	Current Count	Projected Value	Analysis Input Value
1		Boltup[(a)]	23	53	58
2		Design hydrostatic test	38	68	75
3		Startup[(b)]	137	234	246
4		Turbine roll	116	191	201
6		Weekly reduction to 50% power	135	302	317
8		Loss of FW heaters—turbine trip with 100% bypass	4	9	10
9		Loss of FW heaters—partial FW heater bypass	12	17	19
10		SCRAM—turbine generator trip	6	11	12
11		SCRAM—all others	25	30	33
	12a	Control rod drive isolation	20	43	47
	12b	Single control rod drive SCRAM	20	43	47
13		Reduction to 0% power	113	188	197
14		Hot standby [injections]	442	934	1007
	14a	Standby feedwater (SBFW) injection (cold injection into hot piping)	27	42	46
	14a	SBFW injection (cold injection into cold piping)	6	16	18
	14b	RCIC injection (cold injection into hot piping)	10	20	22
	14b	RCIC injection (cold injection into cold piping)[(c)]	378	822	863
	14c	HPCI injection (cold injection into hot piping)	18	26	29
	14c	HPCI injection (cold injection into cold piping)	3	8	9
	14d	FW injection (cold injection into hot piping)[(d)]	0	0	10
	14d	FW injection (cold injection into cold piping)[(d)]	0	0	10
15–17		Shutdown[(b)]	136	233	246
18		Hydrostatic test (1,563 psig)[(e)]	1	1	2
19		Unbolt[(a)]	22	52	58
21		Pre-op blowdown[(f)]	0	0	3

Table 4.3-1 (Continued)
Analyzed Transients with Projections

Event Number		Event Description	Current Count	Projected Value	Analysis Input Value
22		Loss of FW pumps	7	12	13
102		Loss of bottom head/RWCU drain flow	160	257	270
103		Core spray injection	1	3	4
104		Multiple SRV actuation	5	8	9
105		Individual SRV actuation (sum)[g]	611	1333	1435
		Recirculation pump injection on-off-on	21	34	37
		Reactor recirculation pump 'A' hot standby (hours idle with backflow)	303	659	692
		Reactor recirculation pump 'B' hot standby (hours idle with backflow)	222	483	507
		Main steam bypass line time of operation at 30%–45% open (days)	44.87	98	100
		RRS single loop operation	6	14	15
		Operating basis earthquake (OBE)[h]	0	0	2

a. The number of unbolt cycles are set equal to the projected number of boltup events.
b. The number of shutdown cycles is set equal to the projected number of startup events.
c. A total of 329 RCIC injections to cold FW piping were associated with the northeast blackout in August 2003. A similar blackout of that duration is not expected to occur every 13 years. Therefore, projections were based on the operating history from original plant startup to avoid the over-conservatism that would result if the projected number of events were based on only the 13-year period that included August 2003.
d. The current count of FW injection (cold injection into hot piping) and FW injection (cold injection into cold piping) events is zero. This results in zero projected events. For conservatism, 10 injections were included in the analysis input value.
e. The number of hydrostatic test (1563 psig) events was not projected to increase as this event is a pre-startup shop test. For conservatism, one additional event was included in the analysis input value.
f. The current count of pre-op blowdown events is zero. This results in zero projected events. For conservatism, three events were included in the analysis input value.
g. The number of individual SRV actuations is the sum of the projected number of actuations of each individual SRV. A total of 228 "A" SRV actuations were associated with the northeast blackout in August 2003. Therefore, projections were based on the operating history from original plant startup to avoid the over-conservatism that would result if the projected number of events were based on only the 13-year period that included August 2003.
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.

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.

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

<table>
<tr><th>General Location</th><th>Location/Node</th><th colspan="3">CUF</th></tr>
<tr><td>RPV closure region</td><td>Cut V</td><td colspan="3">0.428</td></tr>
<tr><td>RPV closure studs</td><td></td><td colspan="3">0.730</td></tr>
<tr><td>RPV shell</td><td></td><td colspan="3">0.054</td></tr>
<tr><td>Bottom head support skirt</td><td>Node 30</td><td colspan="3">0.527</td></tr>
<tr><td rowspan="3">Steam outlet nozzles</td><td>Safe end</td><td colspan="3">0.047</td></tr>
<tr><td>Nozzle</td><td colspan="3">0.221</td></tr>
<tr><td>Nozzle-vessel intersection</td><td colspan="3">0.212</td></tr>
<tr><td rowspan="4">FW nozzles</td><td></td><td>System Cycling</td><td>Rapid Cycling</td><td>Total</td></tr>
<tr><td>Safe end CS</td><td>0.267</td><td>0.0</td><td>0.267</td></tr>
<tr><td>Safe end SS</td><td>0.585</td><td>0.0</td><td>0.585</td></tr>
<tr><td>Nozzle-vessel intersection</td><td>0.037</td><td>0.021</td><td>0.058</td></tr>
<tr><td rowspan="2">Core spray nozzles</td><td>Nozzle-vessel intersection</td><td colspan="3">0.114</td></tr>
<tr><td>Safe end</td><td colspan="3">0.079</td></tr>
</table>

Table 4.3-2
Reactor Pressure Vessel Cumulative Usage Factors

General Location	Location/Node	CUF
CRD return nozzle	Nozzle-vessel intersection	0.683
	Cap	Bounded by the nozzle
Recirculation outlet nozzles	Nozzle-vessel intersection	0.258
	Safe end	0.103
	Nozzle	0.116
Recirculation inlet nozzles	Nozzle-vessel intersection	0.054
	Safe end	0.002
	Liner, Cut 2, inside surface	0.220
Core ΔP nozzle	Cut II, outside surface	0.637
CRD nozzles	Cut 6	0.645
Basin seal skirt		0.162
Shroud support	Cut 3a	0.111
4" Vent nozzle bolts		0.318
6" Instrument/head spray nozzle bolts		0.382

4.3.1.2 Reactor Pressure Vessel Feedwater Nozzles

As described in UFSAR Section 5.2.1.20, Fermi 2 installed a feedwater sparger and thermal sleeve prior to plant operation to eliminate thermal fatigue concerns on the feedwater nozzle. The vessel was manufactured with unclad feedwater nozzles, so no cladding removal was necessary. The inner thermal sleeve is the feed pipe for the sparger and is sealed against the safe-end with a piston ring. The inner thermal sleeve is welded to the sparger forged tee. As described in UFSAR Section 5.2.1.20, the Fermi 2 feedwater sparger and thermal sleeve design conforms to NUREG-0619.

As a part of the NUREG-0619 review, a plant-specific feedwater nozzle fracture mechanics assessment was completed which determined that 620 startup/shutdowns plus scram events would cause an assumed crack to grow from ¼-inch to the one-inch limit. As seen in Table 4.3-1, the projected number of startup/shutdowns (transients 3 and 15-17) plus scrams (transients 10 and 11) is less than the 620 total cycles determined in this analysis. Therefore, the analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The analysis of the feedwater nozzle includes fatigue from potential rapid cycling behind the thermal sleeves. As shown in Table 4.3-2, the feedwater nozzle has fatigue usage contribution from rapid cycling that is part of the total fatigue usage for that location. The usage is calculated based on time and feedwater temperature in order to include the rapid cycling effect.

The effects of fatigue on the feedwater nozzles will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.3 Reactor Vessel Underclad Cracking

Section 3.1.3.2.5 of NUREG-1800 discusses underclad cracking of base metal forgings clad with austenitic stainless steel. Crack growth due to cyclic loading could occur in reactor vessel shell forgings clad with stainless steel using a high-heat-input welding process. Analysis of growth of intergranular separations (underclad cracks) in the heat-affected zone under austenitic stainless steel cladding may be a TLAA for SA-508-Cl-2 forgings. Table 3.1-1 of NUREG-1800 (Item 18) identifies that this is applicable to pressurized water reactors (it does not identify boiling water reactors). Review of the Fermi 2 records has found no analyses associated with underclad cracking. Consistent with Table 3.1-1 of NUREG-1800, Fermi 2 has no TLAA associated with underclad cracking.

4.3.1.4 Reactor Pressure Vessel Internals

As described in UFSAR Section 4.1.2, the major Fermi 2 reactor internal components are the core (fuel, channels, control rods, and instrumentation), the core support structure (including the core shroud, shroud head separators, top guide, and core support plate), the steam dryer assembly, and the jet pumps. Table 4.3-3 identifies the usage factors that were calculated for the RVI locations that are subject to aging management review.

A reactor vessel general assembly drawing is shown in UFSAR Figure 4.5-1, and a cutaway drawing is shown in UFSAR Figure 5.4-1. The RPV internals are not ASME code pressure boundary components; hence, fatigue evaluation is not a code requirement. ASME analyses were completed for the locations identified in Table 4.3-3. The transients that require tracking are included in Table 4.3-1.

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

Table 4.3-3
RPV Internals Cumulative Usage Factors

General Location	Location/Node	CUF
Core spray lines		0.287
Jet pump riser braces		0.266
Access hole covers	Ring to cover	0.380
	Ring to adaptor ring	0.163
	Adaptor ring to shroud support plate	0.876
Jet pump auxiliary spring wedges	Spring half	0.000
	Right half	0.000

4.3.1.5 Reactor Recirculation Pumps

As identified in UFSAR Table 3.2-1, the reactor recirculation pumps were designed to the 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.

The Fatigue Monitoring Program (Section B.1.17) will manage the effects of aging due to fatigue on the reactor recirculation pumps in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3-4
Reactor Recirculation Pumps Cumulative Usage Factors

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

4.3.1.6 Class 1 Piping

UFSAR Table 3.2-1 provides a summary of the safety classes for the principal structures, systems, and components of the plant. Components of the reactor coolant pressure boundary whose failure could cause a loss of reactor coolant at a rate in excess of the normal makeup system capability are Class 1 components. Class 1 piping is shown on the following LRA drawings.

Table 4.3-5
LRA Drawings for Class 1 Piping

System (System Code)	LRA Drawing
Nuclear boiler system (B21)	LRA-M-2023 LRA-M-2089 LRA-M-2090 LRA-M-3045
Reactor recirculation system (B31)	LRA-M-2833
Control rod drive hydraulic control (CRDHC) system (C11)	LRA-M-2081
Standby liquid control (SLC) system (C41)	LRA-M-2082
Residual heat removal (RHR) system (E11)	LRA-M-2083 LRA-M-2084
Core spray system (E21)	LRA-M-2034
High pressure coolant injection (HPCI) system (E41)	LRA-M-2035
Reactor core isolation cooling (RCIC) system (E51)	LRA-M-2044
Reactor water cleanup (RWCU) system (G33)	LRA-M-2046
Feedwater and standby feedwater system (N21)	LRA-M-2023
Post-accident sampling system (PASS) (P34)	LRA-I-2400-10 LRA-M-2090

Detailed fatigue analyses were generated to analyze multiple locations on each system within the Class 1 boundary. The transients that require tracking are included in Table 4.3-1. Table 4.3-6 provides the highest piping cumulative usage factors, and Table 4.3-7 provides the associated valve cumulative usage factors.

The Fatigue Monitoring Program (Section B.1.17) will monitor the numbers of cycles incurred to assure that action is taken if the numbers approach the values analyzed. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the Class 1 piping in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3-6
Piping Cumulative Usage Factors

General Location	Location/Node	CUF
Div. 2 core spray piping inside containment (CS-01)	Node 95	0.035
Div. 1 core spray piping inside containment (CS-02)	Node 90	0.032
Div. 2 core spray piping outside containment (CS-03)	Node 7	0.007
Div. 1 core spray piping outside containment (CS-05)	Node 6	0.011
Main steam piping outside containment (MS-05)	Node 960	0.003
RWCU supply piping inside drywell	Node 030B	0.043
RWCU supply piping outside drywell	Node 387	0.036
Div. 1 & 2 RHR return piping outside drywell (RHR-02)	Node 5	0.136
Div. 1 & 2 RHR supply piping outside drywell (RHR-07)	Node 9	0.055
Feedwater Loop B piping inside drywell (FW-01)	Node 40	0.071
Feedwater Loop A piping inside drywell (FW-02)	Node 40	0.101
Feedwater Loop B piping outside drywell (FW-04)	Node 16	0.246
Feedwater Loop A piping outside drywell (FW-05)	Node 305	0.128
RCIC steam supply piping outside drywell (RCIC-01)	Node 6	0.001
HPCI steam supply piping outside drywell (HPCI-02)	Nodes 6 & 8	0.002
SLC piping inside containment	N/A	Note 1
SLC piping outside containment	Node 95	0.056
Main steam drain piping inside drywell	Node 50	0.047
Main steam drain piping outside drywell	Node 50	0.022
RPV vent line from RPV to bulkhead piping	Node 17	0.375
RPV vent line from bulkhead to drain manifold piping	Node 33W/412	0.077
RPV vent line from bulkhead to main steam A piping	Node 43W/397	0.501
Main steam line A and HPCI steam piping	Node 102	0.085
Main steam line B and RCIC steam piping	Node 200	0.174
Main steam line C piping	Node 200	0.147
Main steam line D piping	Node 200	0.054

Table 4.3-6 (Continued)
Piping Cumulative Usage Factors

General Location	Location/Node	CUF
Recirculation A and Div. 1 RHRR piping	Node 250	0.012
Recirculation B, RHRS and Div. 2 RHRR piping	Node 516	0.011

Note 1: The projected 40-year CUF for this location is 0.893. The projected 60-year CUF for this location is greater than 1.0, and this has been identified in the Corrective Action Program. Potential solutions include repair of the component, replacement of the component, a more rigorous analysis of the component, or monitoring and tracking cycles to ensure fatigue limits are not exceeded.

Table 4.3-7
Valve Cumulative Usage Factors

General Location	Location/Node	CUF
Atwood & Morrill valves	B2100F010 A & B	0.006
Anchor Darling valves	E1100F050 A & B, Zone 2, 24"	0.020
	B2100F032 A & B, B2100F076 A & B, Zone 2, 20"	0.020
	E2100F006 A & B, Zone 2, 12"	0.018
William Powell valves	G3352F001, G3352F004, G3352F100, G3352F106, G3352F119	0.060
	G3352F102	0.023
	E4150F002, E4150F003	0.121
	E2150F005 A & B, E2100F007 A & B	0.048
	E4150F006	0.116
	B2100F011 A & B, E1100F060 A & B, E1100F067, E1150F008, E1150F009, E1150F015 A & B, E1150F608	0.140
	E5150F008, E5150F007, G3352F101, G3352F220 (NPS $\leq$ 4")	Bound by 0.140
	B2103F016, B2103F019 (NPS $\leq$ 4")	Bound by 0.140
	E5150F013	0.060
GE supplied MSIVs	B2103F022 A-D, B2103F028 A-D	0.350
GE supplied RRS valves	B3105F023 A & B, B3105F031 A & B	0.215
GE supplied SRVs	B2104F013 A, B, C, D, E, F, G, H, J, K, L, M, N, P & R	0.369

4.3.2 Non-Class 1 Fatigue Analyses

4.3.2.1 Piping and In-Line Components

UFSAR Table 3.2-1 provides a summary of the safety classes for the principal structures, systems, and components of the plant. As identified in UFSAR Table 3.2-1, the non-Class 1 piping within the scope of license renewal is built to ASME Section III Code Class 2 or 3 or ANSI B31.1.

The impact of thermal cycles on non-Class 1 components is addressed in the calculation of the allowable stress range. The design of ASME Section III Code Class 2 and 3 or ANSI B31.1 piping systems incorporates a stress range reduction factor for piping design with respect to thermal stresses. In general, a stress range reduction factor of 1.0 in the stress analyses applies for up to 7000 thermal cycles. The allowable stress range is reduced by the stress range reduction factor if the number of thermal cycles exceeds 7000.

Thermal cycles for the non-Class 1 systems have been evaluated for 60 years of plant operation. For many plant systems, significant temperature cycles are coincident with plant heatups and cooldowns, which are limited to well below 7000 cycles, as shown in Table 4.3-1.

Other systems experience transients independent of plant heatups and cooldowns.

- The emergency diesel generators and fire pump diesel engine are tested periodically (approximately monthly), which will not result in the total number of cycles exceeding 7000.
- The CRD system experiences temperature changes during a plant trip, but plant trips are limited to less than 7000.
- Fermi 2 primarily samples utilizing a continuous flow sample stream that is not isolated between samples. Special samples may be drawn infrequently through isolated lines and result in a thermal cycle. Use of these lines for special samples will not result in exceeding 7000 cycles through 60 years of operation.
- There are components subject to aging management review that provide auxiliary steam for heating. The number of cycles is expected to be seasonal and well below 7000 cycles.

These individual system evaluations indicate that 7000 thermal cycles will not be exceeded for 60 years of operation. Therefore, the non-Class 1 piping stress calculations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.2.2 Components Other than Piping

Non-class 1 components other than piping require fatigue analyses if they were built to a section of the code such as ASME Section III, NC-3200 or ASME Section VIII, Division 2. A review of the non-Class 1 components other than piping identified non-Class 1 fatigue analysis applicable to expansion joints (which also includes the component type "flex connections"). Fatigue analyses were identified for expansion joints that assumed a bounding number of cycles. These expansion joint fatigue analyses are treated as TLAAs. Evaluation of these expansion joint analyses determined the number of analyzed cycles was adequate for 60 years of operation. Therefore, these non-Class 1 expansion joint TLAAs are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.3 Effects of Reactor Water Environment on Fatigue Life

Industry test data indicate that certain environmental factors (such as temperature and dissolved oxygen content) in the primary systems of light water reactors could result in greater susceptibility to fatigue than would be predicted by fatigue analyses based on the ASME Section III design fatigue curves. The ASME design fatigue curves were based on laboratory tests in air at low temperatures. Although the fatigue curves derived from laboratory tests were adjusted to account for effects such as data scatter, size, and surface finish, these adjustments may not be sufficient to account for actual reactor water operating environments.

As reported in SECY-95-245, the NRC believes that no immediate staff or licensee action is necessary to deal with the environmentally assisted fatigue issue. In addition, the staff concluded that it could not justify requiring a backfit of the environmental fatigue data to operating plants. However, the NRC concluded that environmentally assisted fatigue should be evaluated for any proposed extended period of operation for license renewal because metal fatigue effects increase with service life.

NUREG/CR-6260 addresses the application of environmental correction factors to fatigue analyses (CUFs) and identifies locations of interest for consideration of environmental effects (Ref. 4-13). NUREG/CR-6260 identified the following component locations to be the most sensitive to environmental effects for General Electric plants.

(1) Reactor vessel shell and lower head

(2) Reactor vessel feedwater nozzle

(3) Reactor recirculation piping (including inlet and outlet nozzles)

(4) Core spray line reactor vessel nozzle and associated Class 1 piping

(5) Residual heat removal nozzles and associated Class 1 piping

(6) Feedwater line Class 1 piping

Fermi 2 evaluated these six locations as a screening evaluation in Table 4.3-8 using the guidance provided in NUREG-1801, Revision 2. NUREG-1801, Revision 2 calls for using the guidance (formulas) provided in NUREG/CR-6909 (Ref. 4-15) to calculate environmentally assisted fatigue correction factors (F_{en}) for nickel alloy components but specifies that NUREG/CR-6583 (Ref. 4-14) may be used for carbon and low alloy steel, and NUREG/CR-5704 (Ref. 4-12) may be used for austenitic stainless steel.

The evaluation of environmentally assisted fatigue included an evaluation of the water chemistry history to determine the cumulative environment for the components when determining the dissolved oxygen. Using the availability data, there was the equivalent of over 12 full years of hydrogen water chemistry (HWC) from 1997 to the end of 2012. A 95 percent availability in 2013 through March 2045 would result in over 30 more years of HWC. This screening analysis will therefore use 42 years as a best estimate of the time for HWC (42 years with HWC and 18 [60-42] years without HWC).

Based on water samples taken prior to HWC control, 140 ppb dissolved oxygen is considered a representative value for the water chemistry in the reactor vessel and attached piping (other than feedwater) for the period of operation prior to HWC. Prior to the implementation of HWC, a representative value for feedwater dissolved oxygen based on sampling is 20 ppb. Following implementation of HWC, the oxygen concentrations in the vessel and attached piping (other than feedwater) are less than 5 ppb. A representative value for feedwater following HWC is 35 ppb.

The following equations were utilized in determining environmental fatigue correction factors.

Carbon Steel

The environmentally assisted fatigue correction factor (F_{en}) for carbon steel is calculated using NUREG/CR-6583, Equation 6.5a.

Low Alloy Steel

The environmentally assisted fatigue correction factor (F_{en}) for low alloy steel is calculated using NUREG/CR-6583, Eq. 6.5b.

Wrought and Cast Austenitic Stainless Steels

The environmentally assisted fatigue correction factor (F_{en}) for wrought and cast austenitic stainless steels is calculated using NUREG/CR-5704, Eq. 13.

Nickel-Chromium-Iron (Ni-Cr-Fe) Alloys

The environmentally assisted fatigue correction factor (F_{en}) for Ni-Cr-Fe alloys is calculated using NUREG/CR-6909, Eq. A.14. To recalculate F_{en} using NUREG-6909 requires the use of updated fatigue tables. This will be addressed by the commitment identified in this section to complete a reanalysis prior to the period of extended operation.

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. DTE will update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment prior to the period of extended operation. This includes applying the appropriate F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). 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. Environmental effects on fatigue for these critical components will be evaluated using one of the following sets of formulae.

Carbon and Low Alloy Steels

- Those provided in NUREG/CR-6583, using the applicable ASME Section III fatigue design curve.
- Those provided in Appendix A of NUREG/CR-6909, using either the applicable ASME Section III fatigue design curve or the fatigue design curve for carbon and low alloy steel provided in NUREG/CR-6909 (Figures A.1 and A.2, respectively, and Table A.1).
- An NRC-approved alternative.

Austenitic Stainless Steels

- Those provided in NUREG/CR-5704, using the applicable ASME Section III fatigue design curve.
- Those provided in NUREG/CR-6909, using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).
- An NRC-approved alternative.

Nickel Alloys

- Those provided in NUREG/CR-6909, using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).
- An NRC-approved alternative.

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[a]	CUF	F_{en}	EAF CUF
1	Reactor vessel shell and lower head	Reactor vessel shell	LAS	0.054	5.72	0.309
1	Reactor vessel shell and lower head	CRD nozzle	NBA[b]	0.645	3.18	> 1
2	Reactor vessel feedwater nozzle	FW nozzle safe end (CS portion)	CS	0.267	1.74	0.465
2	Reactor vessel feedwater nozzle	FW nozzle safe end (SS portion)	SS	0.585	15.35	> 1
2	Reactor vessel feedwater nozzle	Nozzle-vessel intersection	LAS	0.037	5.72	0.212 plus 0.021 rapid cycling = 0.233
3	Reactor recirculation piping (including inlet and outlet nozzles)	RR inlet nozzle liner	SS	0.220	13.25	> 1
3	Reactor recirculation piping (including inlet and outlet nozzles)	RR inlet nozzle safe end	SS	0.002	13.25	0.027
3	Reactor recirculation piping (including inlet and outlet nozzles)	RR inlet nozzle nozzle-vessel intersection	LAS	0.054	5.72	0.309
3	Reactor recirculation piping (including inlet and outlet nozzles)	RR outlet nozzle nozzle-vessel intersection	LAS	0.258	5.72	> 1
3	Reactor recirculation piping (including inlet and outlet nozzles)	RR outlet nozzle safe end	SS	0.103	13.25	> 1
		RR outlet nozzle	LAS	0.116	5.72	0.664
3	Reactor recirculation piping (including inlet and outlet nozzles)	RR piping	SS	0.012	13.25	0.159

Table 4.3-8 (Continued)
EAF Screening of Fermi 2 Locations

NUREG/CR-6260 Generic Location		Fermi 2 Location	Material[a]	CUF	F_{en}	EAF CUF
3	Reactor recirculation piping (including inlet and outlet nozzles)	RR valve	SS	0.215	13.25	> 1
4	Core spray line reactor vessel nozzle and associated Class 1 piping	Core spray nozzle –vessel intersection	LAS	0.114	5.72	0.652
4	Core spray line reactor vessel nozzle and associated Class 1 piping	Core spray nozzle safe end	NBA[b]	0.079	3.18	0.251
4	Core spray line reactor vessel nozzle and associated Class 1 piping	Core spray valve	CS	0.048	1.74	0.084
4	Core spray line reactor vessel nozzle and associated Class 1 piping	Core spray piping	CS	0.035	1.74	0.061
5	Residual heat removal (RHR) nozzles and associated Class 1 piping	RHR valve	CS	0.140	4.07	0.570
5	Residual heat removal (RHR) nozzles and associated Class 1 piping	RHR piping	CS	0.136	4.07	0.554
6	Feedwater line Class 1 piping	FW valve	CS	0.140	1.74	0.244
6	Feedwater line Class 1 piping	FW piping	CS	0.246	1.74	0.428

a. CS: carbon steel. LAS: low alloy steel. NBA: nickel-based alloy. SS: stainless steel.
b. This is a nickel alloy location that will require reanalysis of usage factor with new fatigue curves in accordance with NUREG/CR 6909.

4.4 ENVIRONMENTAL QUALIFICATION (EQ) ANALYSES OF ELECTRIC EQUIPMENT

All operating plants must meet the requirements of 10 CFR 50.49, which defines the scope of electrical components to be included in a program for qualifying electric equipment important to safety (EQ program) and also sets forth requirements for an EQ program. Qualification is established for the environmental and service conditions expected for normal plant operation and also those conditions postulated for plant accidents. A record of qualification for in-scope components must be prepared and maintained in auditable form. Equipment qualification evaluations for EQ components that result in a qualification of at least 40 years, but less than 60 years, are considered TLAAs for license renewal.

The Fermi 2 Environmental Qualification (EQ) of Electric Components Program (EQ Program) (Section B.1.15) manages component thermal, radiation, and cyclical aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the limitations established in the evaluation. The Fermi 2 EQ Program ensures that EQ components are maintained in accordance with their qualification bases.

The Fermi 2 EQ Program is an existing program established to meet Fermi 2 commitments for 10 CFR 50.49. The program is consistent with NUREG-1801, Section X.E1, "Environmental Qualification (EQ) of Electric Components." The Fermi 2 EQ Program will manage the effects of aging on the intended function(s) of EQ components that are the subject of EQ TLAAs for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.5 CONCRETE CONTAINMENT TENDON PRESTRESS ANALYSES

This section is not applicable since the Fermi 2 containment design does not include tendons.

4.6 CONTAINMENT LINER PLATE, METAL CONTAINMENT, AND PENETRATIONS FATIGUE ANALYSES

4.6.1 Primary Containment

As described in UFSAR Section 3.8, the primary containment (a Mark I containment) is a leak-tight steel-plate containment vessel consisting of a light-bulb-shaped drywell and a torus-shaped suppression chamber. As described in UFSAR Section 3.8.2.1.2, the design, fabrication, inspection, and testing of the suppression chamber comply with the requirements of ASME B&PV Code Section III, Class B. The suppression chamber shell, supports, internals, and attachments have also been reevaluated to include the hydrodynamic loading events and analysis methods defined by Topical Report NEDO-21888, Mark I Containment Program Load Definition Report, and NUREG-0661. The appropriate service limits and edition of Section III of the ASME Code, specified in NUREG-0661, were applied to the reanalysis. The Fermi 2 reanalysis is documented in the Plant Unique Analysis Report (PUAR) for Fermi 2.

The usage factors are identified in Table 4.6-1. The SRV 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).

Table 4.6-1
Primary Containment Fatigue Usage Factors

General Location	Location/Node	CUF
Suppression chamber	Torus shell	0.486
	Weld	0.238
Containment vent	Vent header	0.550
	Weld	0.194

4.6.2 Vent Line Bellows

The vent line bellows were specified to be qualified for at least 500 cycles of bellows expansion from the drywell and torus temperature increase following an accident, 600 cycles from operating basis earthquakes (OBE), and 300 cycles from safe shutdown earthquakes. The calculation determined the bellows were qualified for over 6000 cycles. Accident or earthquake cycles have not occurred. Therefore, the bellows analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3 Refueling and Drywell Seal Bellows

Fermi 2 has a refueling bellows attached to the vessel near the reactor vessel flange and a drywell seal bellows outside of the drywell shell. A calculation determined that the refueling bellows were qualified for 45,000 thermal cycles and 9,000 refueling cycles, and the drywell bellows were qualified for 2,800 thermal cycles and 180,000 refueling cycles. The analyzed number of cycles is many more than the expected number of startups and shutdowns and refueling outages through the period of extended operation. Therefore, the bellows analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6.4 Traversing Incore Probe Penetration Bellows

There are penetration bellows at the traversing incore probe (TIP) penetrations. The fatigue analysis determined the bellows were qualified for over 6900 cycles of earthquake or thermal cycles, which are many more cycles than they are expected to experience. Therefore, the bellows remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6.5 Containment Penetrations

As described in UFSAR Section 3.8.2.1.3.1, sleeved penetration assemblies with bellows consist of the process pipe, guard pipe, penetration sleeve bellows, and flued head. For Class 1 piping (Fermi 2 Group A), the design of the flued head meets ASME Section III Class 1 requirements, which specify a fatigue analysis that determines the cumulative usage factor for the flued head. UFSAR Figure 3.8-9 provides a cross-sectional drawing of the penetration assemblies and a listing of the penetrations that utilize this design (designated as Type I). 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.

The specification for the bellows for these penetrations required the bellows be analyzed for at least 200 cycles of normal operation thermal movement and 10 faulted (accident pressure and temperature) cycles. 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).

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.

Table 4.6-2
Cumulative Usage Factors for Flued Head Penetrations

Location/Node	CUF
Penetrations X-9A / B (Feedwater A, B)	0.464
Penetration X-10 (RCIC steam supply)	0.046
Penetration X-12 (RHR supply)	0.416
Penetrations X-16A / B (Core spray A, B)	0.405
Penetrations X-7A-D (Main steam lines A through D)	0.271
Penetration X-8 (Main steam line drains)	0.094
Penetration X-11 (HPCI steam supply)	0.020
Penetrations X-13A / B (RHR return A, B)	0.371
Penetration X-43 (Reactor water clean up)	0.267
Penetration X-42 (Standby liquid control)	0.002

4.7 OTHER PLANT-SPECIFIC TLAAS

4.7.1 Erosion of the Main Steam Line Flow Restrictors

UFSAR Section 5.5.4.4 states that the main steam flow restrictors are fabricated from stainless steel and that only very slow erosion will occur with time. The section later postulates that even with an erosion rate of 0.004 inches per year, the increase in choked flow after 40 years would be no more than 5 percent. Analysis of the erosion rate is evaluated as a TLAA.

DTE Electric evaluated the erosion-corrosion rate for the main steam flow restrictors. This evaluation considered the specific material of the Fermi 2 flow restrictors and determined the expected erosion-corrosion rate when operating at the velocities that would be present following an extended power uprate, which is a greater velocity than anticipated following the MUR/TPO uprate. The evaluation determined that the expected erosion-corrosion rate would be much less than the conservative rate provided in the UFSAR. Assuming the expected erosion-corrosion rate for 60 years of operation, the increase in restrictor-choked flow rate will remain no more than five percent as specified in UFSAR Section 5.5.4.4.

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

4.7.2 Determination of High-Energy Line Break Locations

UFSAR Sections 3.6.1 and 3.6.2 state that the method used to determine the intermediate locations of pipe breaks in high-energy lines includes an evaluation based on CUFs being less than 0.1 if other stress criteria are also met.

Design criteria for piping between the primary containment and outboard isolation valves provide for maximum stresses considering all normal and upset conditions as calculated by the equations in Paragraph NB-3653 of ASME B&PV Code Section III. UFSAR Section 3.6.2.1.2.2 states that pipe breaks were not postulated in the high energy piping between the containment penetration and outboard isolation valves since the piping was conservatively designed and restrained. The calculated CUFs for containment penetration piping were also limited to values less than 0.1 if equation 10 of NB-3653 exceeds 2.4 S_m.

The CUFs, as calculated in the design fatigue analyses, are based on the design transients assumed for the original 40-year life of the plant; therefore, the CUF analyses used in the selection of postulated high-energy line break locations are considered TLAAs.

The Fatigue Monitoring Program (Section B.1.17) identifies when the transients affecting high-energy piping systems are approaching their analyzed numbers of cycles. The modification of the Fermi 2 fatigue calculations to account for the projected cycles for 60 years resulted in locations with CUFs above the 0.1 criteria for HELB exclusion. These have been entered into the

Fermi 2 Corrective Action Program and reanalysis or other corrective actions will be completed as necessary.

DTE Electric will manage the effects of aging associated with the fatigue analyses used in the selection of postulated high-energy line break locations using the Fatigue Monitoring Program (Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.3 Jet Pump Auxiliary Spring Wedge Assembly

Auxiliary spring wedges have been installed on selected jet pumps at Fermi 2. A calculation evaluates relaxation of the spring preload on 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 analysis of 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 assumed a 100 percent capacity factor. Wedges 1 and 2 were installed in RFO 11 and wedge 15 was installed in RFO 9. The wedge numbers correspond to the jet pump on which they are installed. The analysis determined that the projected neutron fluence for wedge 1 slightly exceeds (by four percent) the design fluence prior to the end of the period of extended operation. All other wedges will experience a fluence value less than the analyzed value of 1.2E+20 n/cm^2 (E > 1 MeV) that was calculated as part of the original stress evaluation, including the bounding condition for future wedge installation. For wedge 1, the slight increase in projected fluence results in a slight increase in preload loss. 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.

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

4.7.4 Jet Pump Slip Joint Repair Clamps

The jet pump slip joint repair clamp is connected to the diffuser and the mixer. The original evaluation of the clamps used at Fermi 2 identified the clamp is installed with a preload that may be impacted (relaxed) due to neutron fluence. The relaxation used in the stress analysis was five percent. The analysis that evaluated relaxation of the slip joint repair clamp is a TLAA.

To evaluate the TLAA, a fluence analysis was performed that determined the expected fluence value at the installed position on the jet pump after 52 EFPY of plant operation to be 3.07E+18 n/cm^2 (E > 1 MeV), including the increased fluence due to MUR/TPO. The report states that for stainless steel at fluence levels of 1E+19 n/cm^2 or less, neutron irradiation does not impact the amount of expected relaxation, and therefore, only the thermal relaxation needs to be considered for stress analysis. The original relaxation value remains valid for 52 EFPY of operation, and the stress report results remain applicable for the period of extended operation.

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

4.7.5 Flaw Evaluations for the Reactor Pressure Vessel

During refueling outage 9 (RF9) in 2003, new ASME Section XI, Appendix VIII qualified ultrasonic examination procedures were used for the first time on reactor pressure vessel welds. These new techniques employed greatly improved flaw detection and sizing methods and detected several reactor vessel flaws. A reexamination in RF12 used the phased array technique and identified flaws at two additional locations.

A fracture mechanics evaluation was performed to determine the acceptability of the reactor vessel flaw indications. The analysis evaluated the bounding flaw location for consideration of the pressure-temperature analysis. The analysis determined the indications are acceptable for 52 EFPY with consideration of the effects of MUR/TPO. This TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.7.6 Main Steam Bypass Lines Cumulative Operating Time

In accordance with Detroit Edison's letter to the NRC dated November 7, 1986 (Ref. 4-10), the cumulative time the main steam bypass lines are operated with the bypass valves between 30 and 45 percent open will be reported annually. A cumulative value of 100 days is not to be exceeded without prior NRC notification.

A flaw evaluation that is considered a TLAA concluded that the bypass lines are acceptable for safe operation when operated within the 100-day constraint. Based on this evaluation, the main steam bypass piping that was installed in 1985 has a service life that will allow it to function for the life of the plant including the period of extended operation. Tracking of the cumulative operating time as shown in Table 4.3-1 will be continued for the period of extended operation to ensure this limit is maintained or reanalysis or inspections are performed as required. Fermi 2 will manage the main steam bypass time cumulative usage time using the Fatigue Monitoring Program (Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.7 Crane (Heavy Load) Cycles

UFSAR Section 9.1.4.2.2 states that the reactor building crane meets the structural guidelines of Crane Manufacturers Association of America (CMAA) Specification No. 70. CMAA-70 identifies an allowable stress range based on joint category and service class. The definition of service class considers the load class and the load cycles expected on the crane. The lowest range of cycles in CMAA-70 is 20,000 to 100,000 for Class A cranes; therefore, the analysis associated with the CMAA-70 lift cycle limit is considered a TLAA.

The reactor building crane handles shield plugs, reactor vessel and drywell heads, steam dryer and separator, equipment for the service and maintenance of the reactor, and equipment which is received or shipped through the equipment access lock. The crane was also used during plant construction and will be used for dry fuel cask movement and during decommissioning.

The reactor building crane is primarily used for refueling operations. A review of reactor building crane usage indicates an estimated 69 lifts of over 20,000 lbs (10 tons) for each operating cycle. The reactor building crane has a rated lifting capacity of 125 tons, so a 10-ton lift is only 8 percent (10/125) of its capacity. By the end of the period of extended operation, Fermi 2 will have completed 36 operating cycles, so the reactor building crane will perform approximately 2484 lifts of greater than 10 tons in support of the operating cycles (69 lifts per cycle x 36 cycles).

The number of lifts needed for dry fuel cask loading and movement can be projected at 384 lifts.

The total number of lifts for plant operations and dry fuel cask handling is estimated as 2868 lifts in excess of 10 tons. Applying a 25 percent margin to the total number of lifts results in 3585 lifts. If this number is doubled to account for lifts performed during plant construction and during decommissioning, the total number would be 7170. This number of lifts is far less than the 100,000 cycles established in CMAA Specification No. 70 for a Class A service hoist.

Therefore, the evaluation of lift cycles for the reactor building crane remains valid for the period of extended operation consistent with 10 CFR 54.21(c)(1)(i).

4.8 REFERENCES

4-1 NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR 54 - The License Renewal Rule*, Revision 6, June 2005.

4-2 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 2, December 2010.

4-3 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2, December 2010.

4-4 EPRI Report TR-105090, *Guidelines to Implement the License Renewal Technical Requirements of 10 CFR 54 for Integrated Plant Assessments and Time-Limited Aging Analyses*, November 1995.

4-5 General Electric Report No. NEDO-10029, "An Analytical Study on Brittle Fracture of GE-BWR Vessels Subject to the Design Basis Accident," June 1969.

4-6 10 CFR 50 Appendix G, Fracture Toughness Requirements.

4-7 10 CFR 50 Appendix H, Reactor Vessel Material Surveillance Program Requirements.

4-8 NRC Regulatory Guide 1.99, Radiation Embrittlement of Reactor Vessel Materials, Revision 2.

4-9 NRC Regulatory Guide 1.190, Calculational and Dosimetry Methods for Determining Vessel Neutron Fluence, March 2001.

4-10 NRC Correspondence 86-0154, Service Life of Main Steam Bypass Line, November 7, 1986.

4-11 Ranganath, S., "Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident," Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979 (Accession No. 9110110105 in Public Legacy Library).

4-12 NUREG/CR-5704 (ANL-98/31), *Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels*, April 1999.

4-13 NUREG/CR-6260, (INEL 95/0045) *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, February 1995.

4-14 NUREG/CR-6583 (ANL-97/18), *Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels*, February 1998.

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

Appendix A

Appendix A

Updated Final Safety Analysis Report Supplement

Fermi 2
License Renewal Application

TABLE OF CONTENTS

INTRODUCTION

This appendix provides the information to be submitted in an Updated Final Safety Analysis Report (UFSAR) Supplement as required by 10 CFR 54.21(d) for the Fermi 2 License Renewal Application (LRA). Appendix B of the Fermi 2 LRA provides descriptions of the programs and activities that manage the effects of aging for the period of extended operation. Section 4 of the LRA documents the evaluations of time-limited aging analyses for the period of extended operation. Appendix B and Section 4 have been used to prepare the summary program and activity descriptions for this appendix.

The information presented in this section will be incorporated into the UFSAR following issuance of the renewed operating license. Upon inclusion of the UFSAR supplement in the Fermi 2 UFSAR, future changes to the descriptions of the programs and activities will be made in accordance with 10 CFR 50.59.

The following information documents aging management programs and activities credited in the Fermi 2 license renewal review (Section A.1) and time-limited aging analyses evaluated for the period of extended operation (Section A.2).

AGING MANAGEMENT PROGRAMS AND ACTIVITIES

The Fermi 2 license renewal application (Reference A.3-1) and information in subsequent related correspondence provided sufficient basis for the NRC to make the findings required by 10 CFR 54.29 (Final Safety Evaluation Report) (Reference A.3-2). As required by 10 CFR 54.21(d), this UFSAR supplement contains a summary description of the programs and activities for managing the effects of aging (Section A.1) and a description of the evaluation of time-limited aging analyses for the period of extended operation (Section A.2). The period of extended operation is the 20 years after the expiration date of the original operating license for Fermi 2.

A.1 AGING MANAGEMENT PROGRAMS

The integrated plant assessment for license renewal identified aging management programs necessary to provide reasonable assurance that components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis (CLB) for the period of extended operation. This section describes the aging management programs and activities required during the period of extended operation.

Aging management programs will be implemented prior to entering the period of extended operation. For programs requiring enhancements, the programs are described as including the features that will be in place when the enhancements are fully implemented. Each description lists the enhancements required for the program as it existed when the license renewal application was submitted.

Conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the condition is determined and that corrective action is taken to preclude recurrence. In addition, the identification and cause of the significant condition adverse to quality and the corrective action implemented is documented and reported to appropriate levels of management. The corrective action controls of the Fermi 2 Quality Assurance Program (10 CFR Part 50, Appendix B) are applicable to all aging management programs and activities required during the period of extended operation.

Corrective actions for systems, structures and components are accomplished per the existing Fermi 2 Corrective Action Program and Fermi 2 procedures. The site Corrective Action Program and procedure control program apply to license renewal aging management activities for both safety-related and nonsafety-related structures and components.

The confirmation process is part of the Corrective Action Program and includes the following:

- Reviews to assure that proposed actions are adequate for conditions adverse to quality.
- Tracking and reporting of open corrective actions.
- Review of corrective action effectiveness for significant conditions adverse to quality.

If the confirmation process leads to a corrective action requiring inspection or testing, the corrective action will be documented in accordance with the Corrective Action Program. The Corrective Action Program constitutes the confirmation process for the Fermi 2 aging management programs and activities.

Fermi 2 quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The Fermi 2 QA Program applies to safety-related structures and components. The phrase "Administrative Controls" refers to the adherence to the policies, directives, and procedures and includes the formal review and approval process that procedures and manuals undergo as they are issued and subsequently revised. The Fermi 2 QA Program aspects related to procedure controls and administrative controls (document control requirements for procedures and manuals) and retention of records apply to Fermi 2 aging management activities associated with license renewal for both safety-related and nonsafety-related structures, systems, and components.

The Operating Experience program (OEP) at Fermi 2 and the Corrective Action Program help to assure continued effectiveness of aging management programs through evaluations of operating experience. The OEP implements the requirements of NRC NUREG-0737, *Clarification of TMI Action Plan Requirements*, Section I.C.5, and evaluates site and industry operating experience for impact on Fermi 2. The Corrective Action Program implements the requirements of 10 CFR 50, Appendix B, Criterion XVI and is used to evaluate and effect appropriate actions in response to operating experience relevant to Fermi 2 that indicates a condition adverse to quality or a nonconformance.

Revisions to NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, and other NRC guidance documents on aging management are considered sources of operating experience.

The operating experience program interfaces with and relies on active participation in the Institute of Nuclear Power Operations' operating experience program, as endorsed by the NRC.

In accordance with procedure, incoming operating experience items are screened to identify items that may involve age-related degradation or impact to aging management programs (AMPs), including programs being developed. Items so identified are further evaluated, and AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed.

Plant-specific operating experience associated with aging management and age-related degradation is reported to the industry in accordance with guidelines established in the operating experience program.

DTE will make the following changes to the process for operating experience review (OER).

- Procedures will be revised to add an aging type code to Corrective Action Program documents that describe either plant conditions related to aging or industry operating experience related to aging.
- Procedures will be revised to provide for training of personnel responsible for submitting, screening, assigning, evaluating, or otherwise processing plant-specific and industry operating experience concerning age-related degradation and aging management, as well as for personnel responsible for implementing AMPs, based on the complexity of the job performance requirements and assigned responsibilities.
- Procedures will be revised to specify that evaluations of operating experience concerning age-related degradation will include consideration of the affected systems, structures or components, the environments, materials, aging effects, aging mechanisms, and aging management programs.

DTE currently performs periodic self-assessments on many aging management programs. DTE will enhance the Fermi 2 self-assessment process to provide for periodic evaluation of the effectiveness of each aging management program described in the UFSAR supplement. For new aging management programs, the first evaluation will be performed within five years of implementing the program.

A.1.1 Aboveground Metallic Tanks Program

The Aboveground Metallic Tanks Program is a new program that will manage loss of material and cracking for outdoor tanks within the scope of license renewal that are sited on soil or concrete. Preventive measures to mitigate corrosion and cracking were applied during construction, such as using the appropriate materials, protective coatings, and elevation as specified in design and installation specifications. For the painted carbon steel combustion turbine generator (CTG) fuel oil tank, the program will monitor the external surface condition for indications and precursors of loss of material. For the insulated aluminum condensate storage tank (CST), the program will monitor the condition of a representative sample of the tank external surface for signs of loss of material and cracking, using visual inspections and surface examinations. Exterior portions of the tanks will be inspected in accordance with Table 4a, "Tank Inspection Recommendations," identified in LR-ISG-2012-02. There are no indoor tanks included in this program.

CST internal inspections will be conducted in accordance with Table 4a, identified above. Internal inspections of the CTG fuel oil tank will be conducted in accordance with NUREG-1801, XI.M30.

This program will also manage the bottom surfaces of both in-scope aboveground metallic tanks, which are on concrete ring foundations and sand. The program will require ultrasonic testing (UT) of the tank bottoms to assess the thickness against the thickness specified in the design specification. UT of the tank bottoms will be performed whenever the tanks are drained or at intervals not less than those recommended in Table 4a during the period of extended operation. In accordance with installation and design specifications, the tanks do not employ caulking or sealant at the concrete/tank interface.

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

A.1.2 Bolting Integrity Program

The Bolting Integrity Program manages loss of preload, cracking, and loss of material for accessible closure bolting for safety-related and nonsafety-related pressure-retaining components using preventive and inspection activities. This program does not include the reactor head closure studs or structural bolting. Preventive measures include material selection (e.g., use of materials with an actual yield strength of less than 150 kilo-pounds per square inch [ksi]), lubricant selection (e.g., restricting the use of molybdenum disulfide), applying the appropriate preload (torque), and checking for uniformity of gasket compression where appropriate to preclude loss of preload, loss of material, and cracking. This program supplements the inspection activities required by ASME Section XI for ASME Class 1, 2, and 3 bolting. For ASME Class 1, 2, and 3 accessible bolting and non-ASME Code class accessible bolts, periodic system walkdowns and inspection (at least once per refueling cycle) ensure identification of indications of loss of preload (leakage), cracking, and loss of material before leakage becomes excessive. Identified leaking bolted connections will be monitored at an increased frequency in accordance with the corrective action process. Applicable industry standards and guidance documents, including NUREG-1339, EPRI NP-5769, and EPRI TR-104213, are used to delineate the program.

The Bolting Integrity Program will be enhanced as follows.

- Revise Bolting Integrity Program procedures to ensure consideration of actual yield strength when procuring high-strength bolting material. If procured, closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking.

- Revise Bolting Integrity Program procedures to state that accessible bolting for safety-related pressure-retaining components is inspected for leakage, loss of material, cracking, and loss of preload/loss of prestress. Closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking.

- Revise Bolting Integrity Program procedures to (1) implement applicable recommendations for pressure boundary bolting in NUREG-1339, EPRI NP-5769, and EPRI TR-104213; (2) state both ASME Code class accessible bolted connections and non-ASME Code class accessible bolted connections are inspected at least once per refueling cycle; and (3) include volumetric examination per ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, for closure bolting with actual yield strength greater than or equal to 150 ksi regardless of code classification.

- Revise Bolting Integrity Program procedures to inspect RHRSW, EESW, and EDGSW systems' pump and valve bolting submerged in the RHRSW reservoir at least once every refueling outage.

- Revise Bolting Integrity Program procedures to include the additional guidance and recommendations of EPRI NP-5769 for replacement of ASME pressure-retaining bolts and the guidance provided in EPRI TR-104213 for the replacement of other pressure-retaining bolts.

- Revise Bolting Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Enhancements will be implemented prior to the period of extended operation.

A.1.3 Boraflex Monitoring Program

The Boraflex Monitoring Program manages the aging effect of reduction in neutron-absorbing capacity (change in material properties) in the Boraflex material affixed to spent fuel racks. A monitoring program for the Boraflex panels in the spent fuel storage racks is implemented to assure that no unexpected degradation of the Boraflex material compromises the criticality analysis in support of the design of spent fuel storage racks. The program uses the RACKLIFE computer predictive code to calculate the gamma dose absorbed by and the amount of boron carbide loss from the Boraflex panels. The program includes (a) quarterly sampling and analysis for silica levels in the spent fuel pool water and trending the results by using the RACKLIFE code, (b) performing periodic physical measurements and neutron attenuation testing of surveillance coupons, and (c) areal B-10 density measurement testing of the spent fuel storage racks, such as Boron-10 Areal Density Gage for Evaluating Racks (BADGER) testing, at a frequency of at least once every five years. This program, implemented in response to NRC GL 96-04, assures that the required five percent sub-criticality margin is maintained.

The Boraflex Monitoring Program will be enhanced as follows.

- Revise Boraflex Monitoring Program procedures to include areal B-10 density measurement testing of the spent fuel storage racks, such as BADGER testing, at a frequency of at least once every five years.

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

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.

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 4a of NUREG-1801, XI.M41, is taken based on a lack of soil corrosivity.

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

A.1.5 BWR CRD Return Line Nozzle Program

The BWR Control Rod Drive (CRD) Return Line Nozzle Program manages cracking of the CRD return line nozzle using preventive, mitigative, and inservice inspection activities, in accordance with Fermi 2 commitments to implement the recommendations in NUREG-0619 and ASME Code Section XI, Subsection IWB, Table IWB 2500-1. Examinations that can detect the presence of cracking are performed to assure detection of cracks before the loss of intended function of the CRD return line nozzle. Cracking found during inservice inspection is evaluated in accordance with ASME Code Section XI requirements. The CRD return line nozzle was capped during construction prior to plant operation.

A.1.6 BWR Feedwater Nozzle Program

The BWR Feedwater Nozzle Program manages cracking of the BWR feedwater nozzles using inspection activities to monitor the effects of cracking due to cyclic loading.

This program augments the examinations specified in the ASME Code, Section XI, with the recommendation and schedule of General Electric NE-523-A71-0594, Revision 1, and NUREG-0619 to perform periodic testing of critical regions of the BWR feedwater nozzles. The feedwater nozzles were never clad and include the improved sparger design. Cracking is evaluated and dispositioned in accordance with the ASME Code.

A.1.7 BWR Penetrations Program

The BWR Penetrations Program manages cracking due to cyclic loading or stress corrosion cracking (SCC) and intergranular SCC (IGSCC) of BWR instrument penetrations, control rod drive (CRD) housing and incore housing (ICH) penetrations, and standby liquid control (SLC) nozzles/core ΔP nozzles.

Leakage inspections (VT-2) and ultrasonic inspections are scheduled and performed, flaws are evaluated, scope is expanded as required, and acceptance criteria are provided in accordance with the guidelines of the ASME Code Section XI and NRC-approved BWRVIP-49-A, BWRVIP-47-A, and BWRVIP-27-A.

A.1.8 BWR Stress Corrosion Cracking Program

The BWR Stress Corrosion Cracking Program manages intergranular stress corrosion cracking (IGSCC) in stainless steel or nickel alloy reactor coolant pressure boundary piping and piping welds 4 inches or larger in nominal diameter containing reactor coolant at a temperature above 93°C (200°F) during power operation, regardless of code classification.

Scheduled volumetric examinations provide timely detection of IGSCC and leakage of coolant in accordance with the methods, inspection guidelines, and flaw evaluation criteria delineated in the ASME Code; NUREG-0313, Rev. 2; NRC GL 88-01 and its Supplement 1; NRC-approved BWRVIP-75-A; and other requirements specified per 10 CFR 50.55a with NRC-approved alternatives.

The program includes preventive measures such as induction heating stress improvement, solution annealing, and mechanical stress improvement process to minimize stress corrosion cracking.

A.1.9 BWR Vessel ID Attachment Welds Program

The BWR Vessel ID [inside diameter] Attachment Welds Program manages cracking in structural welds for BWR reactor vessel internal integral attachments using inspections, scheduling, acceptance criteria, and flaw evaluation in conformance with the requirements of ASME Section XI and guidelines of BWRVIP-48-A. The program includes welds between the vessel wall and vessel ID brackets that attach components to the vessel. The internal attachment weld can be a simple weld or a weld build-up pad on the vessel.

A.1.10 BWR Vessel Internals Program

The BWR Vessel Internals Program manages cracking, loss of material due to wear, and reduction of fracture toughness for BWR vessel internal components using inspection and flaw evaluation. The program provides (1) determination of the susceptibility of cast austenitic stainless steel components, (2) accounting for the synergistic effect of thermal aging and neutron irradiation, and (3) implementation of a supplemental examination program, as necessary.

Applicable industry standards and NRC-approved BWRVIP documents provide the basis for scheduling inspections to provide timely detection of aging effects, appropriate NDE inspection techniques, acceptance criteria, flaw evaluation, and repair/replacement, as needed. At Fermi 2, management of the reactor vessel internals is implemented in accordance with ASME Section XI and BWRVIP-94, "BWR Vessel and Internals Project, Program Implementation Guide."

The crack growth rate evaluations and fracture toughness values specified in BWRVIP-14-A, BWRVIP-99-A, and BWRVIP-100-A are used for cracked core shroud welds exposed to the neutron fluence values specified in these BWRVIP reports.

This program also addresses aging degradation of CASS and X-750 alloy. Fermi 2 did not use precipitation-hardened (PH) martensitic stainless steel (e.g., 15-5 and 17-4 PH steel) materials and martensitic stainless steel (e.g., 403, 410, 431 steel) in BWR vessel internal components.

The BWR Vessel Internals Program will be enhanced as follows.

- The susceptibility to neutron or thermal embrittlement for reactor vessel internal components composed of CASS and X-750 alloy will be evaluated.
- BWR Vessel Internals Program procedures will be revised as follows. Portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility, neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions) will be inspected, using an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or within five years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size for the initial inspection of susceptible components will be 100 percent of the accessible component population, excluding components that may be in compression during normal operations.
- BWR Vessel Internals Program procedures will be revised as follows. In accordance with an applicant action item for BWRVIP-25 safety evaluation: (a) install core plate wedges prior to the period of extended operation, or (b) complete a plant-specific analysis that justifies no inspections are required or to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25 and submit the inspection plan, along with the acceptance criteria and justification for the inspection plan, to the NRC two years prior to the period of extended operation.

Enhancements will be implemented prior to the period of extended operation.

A.1.11 Compressed Air Monitoring Program

The Compressed Air Monitoring Program manages loss of material in compressed air systems by periodically monitoring air samples for moisture and contaminants and by opportunistically inspecting internal surfaces within compressed air systems. Air quality is maintained in accordance with limits established by considering manufacturer recommendations, as well as recommendations in EPRI NP-7079 and TR 108147, ASME OM-S/G-1998 (Part 17), ANSI standard ISA-S7.0.01-1996, and ISA-S7.3. Inspection frequency, acceptance criteria, and design and operating reviews are performed in accordance with NRC GL 88-14. The program was developed using applicable industry standards and documents such as ISA-S7.3, Quality Standard for Instrument Air, for guidance on preventive measures, inspection of components, and testing and monitoring air quality.

Periodic internal visual inspections of critical components (compressors, dryers, after-coolers, filters, etc.) are performed to detect signs of corrosion. Air quality is monitored and trended to determine if alert levels or limits are being approached or exceeded. Dew point testing and trending is performed quarterly. Particulates, dew points, hydrocarbon content, and corrosive contaminants are monitored.

The Compressed Air Monitoring Program will be enhanced as follows.

- Revise Compressed Air Monitoring Program procedures to periodically sample, test, and monitor moisture and corrosive contaminants to verify parameters are within acceptable limits in the EDG starting air system to mitigate aging effects such as loss of material due to corrosion.
- Revise Compressed Air Monitoring Program procedures to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters. In addition, include in the Compressed Air Monitoring Program procedures the applicable provisions recommended in EPRI NP-7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17 for air system contaminants, inspection frequency, inspection methods, and acceptance criteria for components subject to aging management review that are exposed to compressed air in the emergency diesel generator (EDG) starting air system and control air system.

Enhancements will be implemented prior to the period of extended operation.

A.1.12 <u>Containment Inservice Inspection – IWE Program</u>

The Containment Inservice Inspection (CII) – IWE Program implements the requirements of 10 CFR 50.55a. The regulations in 10 CFR 50.55a impose the inservice inspection (ISI) requirements of the ASME Boiler and Pressure Vessel (B&PV) Code, Section XI, Subsection IWE, for steel containments (Class MC). The Fermi 2 containment design does not include a concrete containment subject to ASME Section XI, Subsection IWL requirements, and therefore the requirements of Class CC are not applicable. There are no tendons associated with Fermi 2's steel containment vessel. The Fermi 2 primary containment is a General Electric Mark I pressure suppression containment and consists of a drywell, a torus (or suppression chamber), and a vent system connecting the drywell and the torus. The scope of the CII-IWE Program includes the steel containment vessel and its integral attachments, containment equipment hatches and airlock and moisture barriers, and pressure-retaining bolting. Visual inspections monitor loss of material of the steel containment vessel surface areas, including welds and base metal and containment vessel integral attachments, metal shell, personnel and equipment access hatches, and pressure-retaining bolting. The CII-IWE Program specifies acceptance criteria, corrective actions, and provisions for expansion of the inspection scope when identified degradation exceeds the acceptance criteria. The code of record for the examination of the Fermi 2 containment, Class MC components, and related requirements is in accordance with ASME Code Section XI, Subsections IWE, 2001 Edition with the 2003 Addenda, as mandated and modified by 10 CFR 50.55a.

The CII-IWE Program will be enhanced as follows:

- Revise plant procedures to require inspection of the sand pocket drain lines prior to the period of extended operation.
- Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting.
- Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- Revise plant procedures to specify that inspections of the sand pocket drain lines will monitor the internal condition of the drain lines.
- Revise plant procedures to require visual inspection of sand pocket drains to ensure there is no evidence of blockage.
- Revise plant procedures to determine drywell shell thickness in the sand pocket areas before the period of extended operation. From the results, develop a corrosion rate to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation.
- Revise plant procedures to require corrective actions should moisture be detected or suspected in the inaccessible area on the exterior of the drywell shell, including:
  - Identify surfaces requiring augmented inspections for the period of extended operation in accordance with Subsection IWE-1240, as identified in Table IWE-2500-1, Examination Category E-C.
  - Use examination methods that are in accordance with Subsection IWE-2500.
  - Demonstrate through use of augmented inspections performed in accordance with Subsection IWE that corrosion is not occurring or that corrosion is progressing so slowly that the degradation will not jeopardize the intended function of the drywell shell through the period of extended operation.

Enhancements will be implemented prior to the period of extended operation.

A.1.13 Containment Leak Rate Program

The Containment Leak Rate Program consists of tests performed in accordance with the regulations and guidance provided in 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B; Regulatory Guide 1.163, "Performance-Based Containment Leak-Testing Program"; NEI 94-01, "Industry Guideline for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J"; and ANSI/ANS 56.8, "Containment System Leakage Testing Requirements." The Containment Leak Rate Program does not prevent degradation but provides measures for detection of pressure boundary degradation in various systems penetrating containment. Corrective actions are taken if leakage rates exceed acceptance criteria. The program also provides for detection of age-related degradation in material properties of gaskets, O-rings, and packing materials for the containment pressure boundary access points.

Three types of tests are performed under Option B. Type A tests are performed to determine the overall primary containment integrated leakage rate at the loss of coolant accident peak containment pressure. Performance of the integrated leakage rate test per 10 CFR Part 50, Appendix J, Option B, demonstrates the leak-tightness and structural integrity of the containment. Type B and Type C containment local leak rate tests (LLRT), as defined in 10 CFR 50, Appendix J, are intended to detect local leaks and to measure leakage across each pressure-containing or leakage-limiting boundary of containment penetrations. Containment leakage rate tests are performed at frequencies that comply with the requirements of 10 CFR Part 50, Appendix J, Option B.

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.

The One-Time Inspection Program describes inspections planned to verify that the Diesel Fuel Monitoring Program has been effective at managing aging effects.

The Diesel Fuel Monitoring Program will be enhanced as follows.

- Revise Diesel Fuel Monitoring Program procedures to monitor and trend water and sediment, particulates, and levels of microbiological organisms in the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and combustion turbine generator (CTG) fuel oil tank quarterly. In addition, revise program procedures to state that biocides or corrosion inhibitors may be added as a preventive measure or are added if periodic testing indicates biological activity or evidence of corrosion, respectively.

- Revise the Diesel Fuel Monitoring Program procedures to include a ten-year periodic cleaning and internal visual inspection of the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank with the following instructions. The cleanings and internal inspections will be performed at least once during the ten-year period prior to the period of extended operation and at succeeding ten-year intervals. If visual inspection is not possible, perform a volumetric inspection. If evidence of degradation is observed during visual inspection, perform a volumetric examination of the affected area.

Enhancements will be implemented prior to the period of extended operation.

A.1.15 Environmental Qualification (EQ) of Electric Components Program

The Environmental Qualification (EQ) of Electric Components Program implements the requirements of 10 CFR 50.49. As required by 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluation. The Fermi 2 EQ Program manages component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. Reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed.

In accordance with 10 CFR 54.21(c)(1)(iii), implementation of the EQ Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

A.1.16 External Surfaces Monitoring Program

The External Surfaces Monitoring Program manages aging effects of components fabricated from metallic, elastomeric, and polymeric materials through periodic visual inspection of external surfaces during system inspections and walkdowns for evidence of leakage, loss of material (including loss of material due to wear), cracking, fouling, and change in material properties. When appropriate for the component and material, physical manipulation, such as touching, pressing, flexing, and bending, is used to augment visual inspections to confirm the absence of hardening and loss of strength in non-metallic materials. The External Surfaces Monitoring Program is also credited for situations where the material and environment combinations are the same for the internal and external surfaces such that the external surfaces are representative of the internal surfaces.

Inspections are performed at a frequency of at least once per refueling cycle by personnel qualified through plant-specific programs. Deficiencies are documented and evaluated under the Corrective Action Program. Surfaces that are not readily visible during plant operations and refueling outages are inspected when they are made accessible and at such intervals that would ensure the components' intended functions are maintained. Surfaces that are insulated are inspected when exposed at such intervals to ensure the components' intended functions are maintained.

For polymeric materials, the visual inspection will include 100 percent of the accessible components. The sample size of polymeric components that receive physical manipulation is at least 10 percent of the available surface area.

Acceptance criteria are defined to ensure that the need for corrective action is identified before a loss of intended function. For stainless steel, a clean shiny surface is expected. For flexible polymers, a uniform surface texture (no cracks) and no change in material properties (e.g., hardness, flexibility, physical dimensions, color unchanged from when the material was new) are expected. For rigid polymers, no surface changes affecting performance, such as erosion, cracking, crazing, checking, and chalking, are acceptable.

The External Surfaces Monitoring Program will be enhanced as follows.

- Revise External Surfaces Monitoring Program procedures to clarify that periodic inspections will be performed of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2).

- Revise External Surfaces Monitoring Program procedures to inspect 100 percent of accessible components at least once per refueling cycle and to ensure required walkdowns include instructions to inspect for the following related to metallic components:
    - Corrosion (loss of material).
    - Leakage from or onto external surfaces (loss of material).
    - Worn, flaking, or oxide-coated surfaces (loss of material).
    - Corrosion stains on thermal insulation (loss of material).
    - Protective coating degradation (cracking, flaking, and blistering).
    - Leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides (cracking).
- Revise External Surfaces Monitoring Program procedures to include instructions for monitoring aging effects for flexible polymeric components through physical manipulations of the material, with a sample size for manipulation of at least ten percent of the available surface area. Inspect accessible surfaces for the following:
    - Surface cracking, crazing, scuffing, dimensional changes (e.g., ballooning and necking).
    - Discoloration.
    - Exposure of internal reinforcement for reinforced elastomers.
    - Hardening as evidence by loss of suppleness during manipulation where the component and material are appropriate to manipulation.
    - Shrinkage, loss of strength.
- Revise External Surfaces Monitoring Program procedures to ensure surfaces that are insulated will be inspected when the external surface is exposed (i.e., during maintenance).
- Revise External Surfaces Monitoring Program procedures to include acceptance criteria for the parameters observed.
    - Metals should not have any indications of relevant degradation.
    - Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color.
    - Rigid polymers should have no erosion, cracking, crazing, or chalking.
- Revise External Surfaces Monitoring Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Enhancements will be implemented prior to the period of extended operation.

A.1.17 Fatigue Monitoring Program

The Fatigue Monitoring Program ensures that fatigue usage remains within allowable limits for components identified to have a TLAA by (a) tracking the number of critical thermal and pressure transients for selected components, (b) verifying that the severity of monitored transients are bounded by the design transient definitions for which they are classified, (c) assessing the impact of the reactor coolant environment on a set of sample critical components including those from NUREG/CR-6260 and those components identified to be more limiting than the components specified in NUREG/CR-6260, and (d) addressing applicable fatigue exemptions. Tracking the number of critical thermal and pressure transients for the selected components ensures a code design usage factor of less than or equal to 1, including environmental effects where applicable. The environmental effects on fatigue for the identified critical components will be evaluated.

The program monitors the number of occurrences for the plant transients that cause significant fatigue usage. The program also provides for updates of fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified.

The Fatigue Monitoring Program will be enhanced as follows.

- Revise Fatigue Monitoring Program procedures to monitor and track critical thermal and pressure transients for components that have been identified to have a fatigue TLAA.

- Develop environmentally assisted fatigue (EAF) usage calculations that consider the effects of the reactor water environment for a set of sample reactor coolant system components. This sample set will include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they are found more limiting than those considered in NUREG/CR-6260. Environmental correction factors will be determined using formulae consistent with those recommended in NUREG-1801, X.M1.

- Revise Fatigue Monitoring Program procedures to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified. For components with assumed minimal cycle counts, ensure that exemption assumptions are not exceeded.

- 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.

The second enhancement for EAF usage calculations will be implemented at least two years prior to entering the period of extended operation. All other enhancements will be implemented prior to the period of extended operation.

A.1.18 Fire Protection Program

The Fire Protection Program manages the following through periodic visual inspection of components and structures with a fire barrier intended function.

- Carbon steel components (loss of material).
- Concrete components (cracking and loss of material).
- Masonry walls (cracking and loss of material).
- Fire resistant materials (loss of material, change in material properties, cracking/ delamination, and separation).
- Elastomer components (increased hardness, shrinkage, and loss of strength).

The program includes visual inspections of not less than ten percent of each type of penetration seal at a frequency described in the Technical Requirements Manual (TRM). These inspections examine any sign of degradation, such as cracking, seal separation from walls and components, separation of layers of material, rupture and puncture of seals that are directly caused by increased hardness, and shrinkage of seal material due to loss of material. If any signs of degradation are detected within the sample, the scope of the inspection is expanded to include additional seals.

Visual inspections of the fire barrier walls, ceilings, and floors in structures within the scope of license renewal are performed at a frequency described in the TRM. Inspections of fire barriers include inspections of coatings and wraps. Visual inspection of the fire barrier walls, ceilings, and floors and other fire barrier materials to detect any sign of degradation, such as cracking and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates, are performed to ensure their intended fire protection functions are maintained.

Periodic visual inspections and functional tests are utilized to manage the aging effects of fire doors. Visual inspections of fire door surfaces and functional testing of fire door closing mechanisms and latches are performed at a frequency described in the TRM.

The Fire Protection Program performs visual periodic inspections and functional tests of the CO_2 and Halon systems in accordance with the TRM. These actions verify that the systems actuate correctly and that system integrity is maintained by inspecting for conditions of corrosion that could lead to a loss of material.

The Fire Protection Program will be enhanced as follows.

- Revise Fire Protection Program procedures to perform visual inspections to manage loss of material of the Halon and CO_2 fire suppression system.

- Revise Fire Protection Program procedures to require visual inspections of in-scope (a) fire wrap and fire stop materials constructed of fibersil cloth, cerafoam, kaowool, thermolag, flamemastic, and pyrocrete for loss of material, change in material properties, cracking/delamination, separation, increased hardness, shrinkage, and loss of strength; (b) carbon steel penetration sleeves for loss of material; (c) steel framing, roof decking, and floor decking for loss of material; (d) concrete fire barriers including manways, manhole covers, handholes, and roof slabs for loss of material and cracking; and (e) railroad bay airlock doors for loss of material. Inspections are performed at a frequency in accordance with the NRC-approved fire protection program or at least once every refueling cycle.

Enhancements will be implemented prior to the period of extended operation.

A.1.19 Fire Water System Program

The Fire Water System Program manages loss of material and biofouling for components in fire water systems using preventive, inspection, and monitoring activities, including periodic flush tests, and testing or replacement of sprinkler heads. Applicable industry standards and guidance documents are used to delineate the program.

Consistent with NFPA 25, the Fermi 2 program includes system performance testing in accordance with the UFSAR and TRM. The periodic flow testing includes monitoring the pressure of tested pipe segments, which verifies that system pressure remains adequate for system intended functions. Results are trended. Periodic flushing is also performed in accordance with the TRM.

Wall thickness is evaluated to ensure minimum wall thickness is maintained. Wall thickness measurements are determined by volumetric testing, or as an alternative to nonintrusive testing, by visually monitoring internal surface condition upon each entry into the system for routine or corrective maintenance. The use of internal visual inspections is acceptable when inspections can be performed (based on past maintenance history) on a representative number of locations. These inspections will be performed before the period of extended operation and at plant-specific intervals, based on the initial test results, during the period of extended operation. Periodic visual inspections of fire water system internals monitor surface condition for indication of loss of material or biofouling.

Other requirements of the program include testing and maintaining fire detectors and visually inspecting fire hydrants to detect signs of corrosion. Fire hydrant flow tests are performed annually to ensure fire hydrants can perform their intended function. Water system pressure is continuously monitored such that loss of pressure is immediately detected and corrective action initiated. If not replaced, sprinkler heads are tested before the end of 50-year sprinkler service life and every ten years thereafter during the period of extended operation.

Program acceptance criteria are (a) the water based fire protection system can maintain required pressure, (b) no unacceptable signs of degradation are observed during nonintrusive or visual inspections, (c) minimum design pipe wall thickness is maintained, and (d) no biofouling exists in the sprinkler systems that could cause corrosion in the sprinklers.

The Fire Water System Program will be enhanced as follows.

- Revise Fire Water System Program procedures to include periodic visual inspection of fire water system internals surface condition for evidence of loss of material.
- Revise Fire Water System Program procedures to include one of the following inspection options.

  (1) Wall thickness evaluations of fire protection piping using nonintrusive techniques (e.g., volumetric testing) to identify evidence of loss of material will be performed prior to the period of extended operation and periodically thereafter. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.

  OR

  (2) A visual inspection of the internal surface condition of a representative sample of fire protection piping will be performed. The visual inspections can be opportunistic or planned as needed to obtain a representative sample prior to the period of extended operation. The frequency of inspections during the period of extended operation will be determined through an engineering evaluation of the results of previous inspections of fire water piping.

- Revise Fire Water System Program procedures to include testing or replacement of sprinkler heads. If testing is chosen, a representative sample of sprinkler heads will be tested before the end of the 50-year sprinkler head service life and at ten-year intervals thereafter during the period of extended operation. NFPA-25 defines a representative sample of sprinklers. If replacement of the sprinkler heads is chosen, all sprinklers that have been in service for 50 years will be replaced.
- Revise Fire Water System Program procedures to include inspection of fire water system internals for no unacceptable signs of degradation observed during nonintrusive or visual inspection of components and no biofouling found in the sprinkler systems that could cause corrosion in the sprinklers.

Enhancements will be implemented prior to the period of extended operation.

A.1.20 Flow-Accelerated Corrosion Program

The Flow-Accelerated Corrosion (FAC) Program manages loss of material due to wall thinning caused by FAC for carbon steel piping and components through (a) performing an analysis to determine systems susceptible to FAC, (b) conducting appropriate analysis to predict wall thinning, (c) performing wall thickness measurements based on wall thinning predictions and operating experience, and (d) evaluating measurement results to determine the remaining service life and the need for replacement or repair of components.

The program also manages wall thinning due to various erosion mechanisms in treated water and steam systems for all materials that may be identified through industry or plant-specific operating experience.

The program relies on implementation of guidelines published by EPRI in NSAC-202L, Rev. 3, and internal and external operating experience. The program uses a predictive code for portions of susceptible systems with design and operating conditions that are amenable to computer modeling. When field measurements identify that the predictive code is not conservative, the model is recalibrated. The model is also adjusted as a result of any power uprates.

A representative sample of components is selected based on the most susceptible locations for wall thickness measurements at a frequency in accordance with NSAC-202L Rev. 3 guidelines to ensure that FAC degradation is identified and mitigated before the component integrity is challenged. Inspections are performed using ultrasonic or other approved testing techniques capable of detecting wall thickness. Measurement results are used to confirm predictions and to plan long-term corrective action. In the event measurements of wall thinning exceed predictions, the extent of the wall thinning is determined as a part of the Corrective Action Program. Components predicted to reach the minimum allowed wall thickness before the next scheduled outage are isolated, repaired, replaced, or reevaluated under the Corrective Action Program.

The FAC Program will be enhanced as follows.

- Revise procedures to indicate that the FAC Program also manages loss of material due to erosion mechanisms of cavitation, flashing, liquid droplet impingement, and solid particle erosion for any material in treated water or steam environments. Include in program procedures a susceptibility review based on internal operating experience; external operating experience; EPRI TR-1011231, *Recommendations for Controlling Cavitation, Flashing, Liquid Droplet Impingement, and Solid Particle Erosion in Nuclear Power Plant Piping*; and NUREG/CR-6031, *Cavitation Guide for Control Valves.* Piping subject to erosive conditions is not excluded from inspections, even if it has been replaced with FAC-resistant material. Periodic wall thickness measurements of such piping should continue until the effectiveness of corrective actions is assured.

- Revise FAC Program procedures to specify that downstream components are monitored for wall thinning when susceptible upstream components are replaced with FAC-resistant materials.

Enhancements will be implemented prior to the period of extended operation.

A.1.21 Inservice Inspection Program

The Inservice Inspection (ISI) Program manages loss of material, cracking, and reduction in fracture toughness for ASME Class 1, 2, and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting, using volumetric, surface, and/or visual examination and leakage testing as specified in ASME Code Section XI, 2001 Edition with 2003 Addenda. The examinations, scheduling, acceptance criteria, flaw evaluation, and re-examinations are in accordance with the requirements identified in ASME Section XI with NRC-approved alternatives.

Additional limitations, modifications, and augmentations approved under the provisions of 10 CFR 50.55a with NRC-approved alternatives are included as a part of this program. Every ten years this program is updated to the latest ASME Section XI code edition and addendum approved by the NRC per 10 CFR 50.55a. Repair and replacement activities for these components are covered in Subsection IWA of the ASME code edition of record.

A.1.22 Inservice Inspection – IWF Program

The Inservice Inspection (ISI) – IWF Program performs periodic visual examinations of ASME Class 1, 2, 3 and MC piping and component supports to determine general mechanical and structural condition or degradation of component supports such as verification of clearances, settings, physical displacements, loose or missing parts, debris, corrosion, wear, erosion, or the loss of integrity at welded or bolted connections. The ISI-IWF Program is implemented through plant procedures which provide administrative controls, including corrective actions, for the conduct of activities that are necessary to fulfill the requirements of ASME Section XI, as mandated by 10 CFR 50.55a. The monitoring methods are effective in detecting the applicable aging effects, and the frequency of monitoring is adequate to prevent significant degradation.

The ISI-IWF Program will be enhanced as follows.

- Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting.

- Revise plant procedures to require structural bolting replacement and maintenance activities to include appropriate preload and proper tightening (torque or tension) as recommended in EPRI documents, American Society for Testing of Materials (ASTM) standards, American Institute of Steel Construction (AISC) Specifications, as applicable.

- Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- Revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts or bolts, and cracking of concrete around the anchor bolts.
- Revise plant procedures to identify the following unacceptable conditions:
  - Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support.
  - Cracked or sheared bolts, including high-strength bolts, and anchors.

Enhancements will be implemented prior to the period of extended operation.

A.1.23 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (OVHLL) Program performs periodic visual examinations and preventive maintenance to manage loss of material due to corrosion, loose bolting or rivets, and crane rail wear of cranes and hoists, based on industry standards and guidance documents. The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes and hoists. The program includes structural components, including structural bolting, that make up the bridge, the trolley, lifting devices, and rails in the rail system and includes cranes and hoists that meet the provisions of 10 CFR 54.4(a)(1) and (a)(2) as well as NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The activities rely on visual examinations and functional testing to ensure that cranes and hoists are capable of sustaining their rated loads, thus ensuring their intended function is maintained during the period of extended operation.

The Inspection of OVHLL Program will be enhanced as follows.

- Revise plant procedures to specify the monitoring of rails in the rail system for loss of material due to wear; monitor structural components of the bridge, trolley and hoists for deformation, cracking, and loss of material due to corrosion; and monitor structural connections/bolting for loose or missing bolts, nuts, pins or rivets and any other conditions indicative of loss of bolting integrity.

- Revise plant procedures to specify inspection frequency requirements will be in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series.

- Revise plant procedures to require that significant loss of material due to wear of rails in the rail system and any sign of loss of bolting integrity will be evaluated in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series.

- Revise plant procedures to specify that maintenance and repair activities will utilize the guidance provided in ASME B30.2 or other appropriate standard in the ASME B30 series.

Enhancements will be implemented prior to the period of extended operation.

A.1.24 Internal Surfaces in Miscellaneous Piping and Ducting Components Program

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program that will manage fouling, cracking, loss of material, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of piping and components in environments other than open-cycle cooling water, closed treated water, and fire water. Program periodic surveillances or maintenance activities will be conducted when the surfaces are accessible for visual inspection.

Where practical, the inspections will focus on the bounding or lead components most susceptible to aging because of time in service and severity of operating conditions. At a minimum, in each ten-year period during the period of extended operation, a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population will be inspected. Opportunistic inspections will continue in each period despite meeting the sampling limit.

For metallic components, visual inspection of surface conditions will be used to detect evidence of loss of material and fouling. For non-metallic components, visual inspections and physical manipulation or pressurization will be used to detect evidence of surface discontinuities such as cracking and change in material properties. Visual examinations of elastomeric components will be accompanied by physical manipulation such that changes in material properties are readily observable. The sample size for physical manipulation will be at least ten percent of accessible surface area, including visually identified suspect areas.

Specific acceptance criteria will be as follows:

- Stainless steel: clean surfaces, shiny, no abnormal surface condition.
- Metals: no abnormal surface condition.
- Elastomerics: no change in material properties.
- Rigid polymers: no surface changes affecting performance such as erosion and cracking.

Conditions that do not meet the acceptance criteria will be entered into the Corrective Action Program for evaluation. Any indications of relevant degradation will be evaluated using design standards, procedural requirements, current licensing basis, and industry codes or standards.

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

A.1.25 Masonry Wall Program

The Masonry Wall Program is based on guidance provided in I.E. Bulletin 80-11, "Masonry Wall Design," and Information Notice (IN) 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to I.E. Bulletin 80-11." The scope of the Masonry Wall Program includes masonry walls within the scope of license renewal as delineated in 10 CFR 54.4. The program manages loss of material and cracking of masonry walls so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation. The program will be implemented as part of the Structures Monitoring Program (Section A.1.42).

The program includes visual inspections of masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are masonry walls required by 10 CFR 50.48, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components. Structural steel components, steel edge supports, and steel bracing of masonry walls are managed by the Structures Monitoring Program (Section A.1.42).

Enhancements to this program are included in the enhancements to the Structures Monitoring Program (Section A.1.42).

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. 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.

As an alternative to thermography or measuring connection resistance of accessible bolted connections covered with heat shrink tape, sleeving, insulating boots, etc., visual inspection of insulation material may be used to detect surface anomalies, such as embrittlement, cracking, chipping, melting, discoloration, swelling, or surface contamination. When this alternative visual inspection is used to check bolted connections, the first inspection is completed prior to the period of extended operation and every five years thereafter.

This program will be used instead of the Structures Monitoring Program (Section A.1.42) for external surfaces of the bus enclosure assemblies.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.E4, Metal-Enclosed Bus.

A.1.27 Neutron-Absorbing Material Monitoring Program

The Neutron-Absorbing Material Monitoring Program provides reasonable assurance that degradation of the neutron-absorbing material (Boral) used in spent fuel pools that could compromise the criticality analysis will be detected. The program relies on periodic inspection, testing, and other monitoring activities to assure that the required five percent sub-criticality margin is maintained during the period of extended operation. The program monitors loss of material and changes in dimension, such as blisters, pits, and bulges that could result in a loss of neutron-absorbing capability. The parameters monitored include physical measurements and geometric changes in test coupons. The frequency of testing will be based on the condition of the neutron-absorbing material, justified with plant-specific operating experience, prior to the period of extended operation, at a minimum of once every ten years in the period of extended operation. The approach to relating measurement results of the coupons to the spent fuel neutron-absorber materials considers the spent fuel loading strategy. In the event that a loss of neutron-absorbing capacity is anticipated based on coupon testing, additional testing will be performed to ensure the sub-criticality requirements are met.

The Neutron-Absorbing Material Monitoring Program will be enhanced as follows.

- Prior to the period of extended operation, revise Neutron-Absorbing Material Monitoring Program procedures to establish an inspection frequency, justified with plant-specific operating experience, of at least once every ten years, based on the condition of the neutron-absorbing material.
- Revise Neutron-Absorbing Material Monitoring Program procedures to perform trending of coupon testing results to determine the rate of degradation. Ensure the predicted boron-10 areal density will be sufficient to maintain the subcritical conditions required by technical specifications until the next coupon test.

Enhancements will be implemented prior to the period of extended operation.

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, 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.

The inspections will be performed prior to the period of extended operation.

A.1.29 Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program

The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program is a new condition monitoring program that will manage the aging effect of reduced insulation resistance on inaccessible power (400 V to 13.8 kV) cables that have a license renewal intended function. The program calls for inaccessible or underground (e.g., in conduit, duct bank, or direct buried) power (greater than or equal to 400 volts) cables exposed to significant moisture, to be tested at least once every six years to provide an indication of the condition of the conductor insulation, with the first tests occurring before the period of extended operation. The specific type of test to be used should be a proven, commercially available test capable of detecting reduced insulation resistance of the cable's insulation system due to wetting or submergence. The applicant can assess the condition of the cable insulation with reasonable confidence using one or more of the following techniques: dielectric loss (dissipation factor/power factor), AC voltage withstand, partial discharge, step voltage, time domain reflectometry, insulation resistance and polarization index, line resonance analysis, or other testing that is state-of-the-art at the time the tests are performed. One or more tests are used to determine the condition of the cables so they will continue to meet their intended function during the period of extended operation.

The program will include periodic inspections for water accumulation in manholes within the scope of this program. The inspection frequency for water collection is established and performed based on plant-specific operating experience with cable wetting or submergence in manholes (i.e., the inspection is performed periodically based on water accumulation over time and event-driven occurrences such as heavy rain or flooding). The periodic inspection should occur at least annually. The inspection should include direct observation that cables are not wetted or submerged, that cables/splices and cable support structures are intact, and dewatering/drainage systems (i.e., sump pumps) and associated alarms operate properly. In addition, operation of dewatering devices should be inspected and operation verified prior to any known or predicted heavy rain or flooding.

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

A.1.30 Non-EQ Instrumentation Circuits Test Review Program

The Non-EQ Instrumentation Circuits Test Review Program is a new performance monitoring program that will manage the aging effects of applicable cables in the following systems or sub-systems.

- Neutron monitoring
  - Intermediate range channels (IRMs)
  - Average power range monitors (includes local power range monitors [LPRM] detector strings)
- Process radiation monitoring
  - Control center emergency air inlet radiation monitors
  - Fuel pool ventilation exhaust radiation monitors
  - Main steam line radiation monitors

The Non-EQ Instrumentation Circuits Test Review Program calls for the review of calibration results or findings of surveillance tests on electrical cables and connections used in circuits with sensitive, high-voltage, low-level current signals, such as radiation monitoring and nuclear instrumentation, to provide an indication of the existence of aging effects based on acceptance criteria related to instrumentation circuit performance. By reviewing the results obtained during normal calibration or surveillance, an applicant may detect severe aging degradation prior to the loss of the cable and connection intended function. The review of calibration results or findings of surveillance tests is performed at least once every ten years. In cases where cables are not included as part of calibration or surveillance program testing circuit, a proven cable test (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable system insulation condition as justified in the application) is performed. The test frequency is based on engineering evaluation and is at least once every ten years.

For sensitive instrumentation circuit cables that are disconnected during instrument calibrations, testing using a proven method for detecting deterioration for the insulation system (such as insulation resistance tests or time domain reflectometry) will occur at least once every ten years, with the first test occurring before the period of extended operation. Applicable industry standards and guidance documents will be used to delineate the program.

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

A.1.31 Non-EQ Insulated Cables and Connections Program

The Non-EQ Insulated Cables and Connections Program is a new condition monitoring program that provides reasonable assurance the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation[1] and moisture can be maintained consistent with the current licensing basis through the period of extended operation.

The program consists of accessible insulated electrical cables and connections installed in adverse localized environments to be visually inspected at least once every ten years for cable jacket and connection insulation surface anomalies, such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination, that could indicate incipient conductor insulation aging degradation from temperature, radiation, or moisture.

An adverse localized environment is a condition in a limited plant area that is significantly more severe than the plant design environment for the cable or connection insulation materials.

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

1. Reduced insulation resistance from an environment of radiation and air (oxygen) includes radiolysis, photolysis of organics, or radiation induced oxidation. Photolysis is limited to UV sensitive materials.

A.1.32 Oil Analysis Program

The Oil Analysis Program ensures that loss of material and fouling are not occurring by maintaining the quality of the lubricating oil. The program ensures that contaminants (primarily water and particulates) are within acceptable limits. Testing activities include sampling and analysis of lubricating oil for detrimental contaminants. Testing results indicating the presence of water in oil samples initiate corrective action that may include evaluating for in-leakage.

The One-Time Inspection Program utilizes inspections or non-destructive evaluations of representative samples to verify that the Oil Analysis Program has been effective at managing the aging effects.

The Oil Analysis Program will be enhanced as follows.

- Revise Oil Analysis Program procedures to identify components within the scope of the program.
- Revise Oil Analysis Program procedures to provide a formalized analysis technique for particulate counting.
- Revise Oil Analysis Program procedures to include the sampling and testing recommendations of equipment manufacturers or industry standards.

Enhancements will be implemented prior to the period of extended operation.

A.1.33 One-Time Inspection Program

The One-Time Inspection Program is a new program that will consist of a one-time inspection of selected components to accomplish the following:

- Verify the effectiveness of an aging management program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The aging effects evaluated are loss of material, cracking, and fouling.
- Confirm the insignificance of an aging effect for situations in which additional confirmation is appropriate using inspections that verify degradation is not occurring.
- Trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.

The sample size will be 20 percent of the components in each material-environment-aging effect group up to a maximum of 25 components. Identification of inspection locations will be based on the potential for the aging effect to occur. Examination techniques will use established NDE methods with a demonstrated history of effectiveness in detecting the aging effect of concern, including visual, ultrasonic, and surface techniques. Acceptance criteria will be based on applicable ASME or other appropriate standards, design basis information, or vendor-specified requirements and recommendations. Any indication or relevant condition of degradation detected is evaluated. The need for follow-up examinations will be evaluated based on inspection results.

The One-Time Inspection Program will not be used for structures or components with known age-related degradation mechanisms or if the environment in the period of extended operation is not expected to be equivalent to that in the prior 40 years. In these cases, a periodic plant specific inspection will be performed.

The following table identifies potential inspection methods for specific aging effects.

Parameters Monitored and Inspection Methods for Specific Aging Effects

Aging Effect	Aging Mechanism	Parameters Monitored	Inspection Methods
Loss of material	Crevice corrosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Loss of material	Galvanic corrosion	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	General corrosion	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	Microbiologically induced corrosion (MIC)	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	Pitting corrosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Loss of material	Erosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Reduction of heat transfer	Fouling	Surface condition	Visual (VT-3 or equivalent)
Cracking	SCC or cyclic loading	Surface condition	Enhanced visual (EVT-1 or equivalent) or surface examination (magnetic particle, liquid penetrant) or volumetric (radiographic testing or UT)

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

Diesel Fuel Monitoring Program (Section A.1.14)	One-time inspection activity will verify the effectiveness of the Diesel Fuel Monitoring Program by confirming that unacceptable loss of material is not occurring.
Oil Analysis Program (Section A.1.32)	One-time inspection activity will verify the effectiveness of the Oil Analysis Program by confirming that unacceptable loss of material and fouling is not occurring.
Water Chemistry Control – BWR Program (Section A.1.43)	One-time inspection activity will verify the effectiveness of the Water Chemistry Control – BWR Program by confirming that unacceptable cracking, loss of material, and fouling is not occurring.
Stainless steel reactor vessel flange leak off piping and valve body	One-time inspection activity will confirm that cracking is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of core spray piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of residual heat removal (RHR) piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of high pressure coolant injection (HPCI) turbine exhaust piping passing through the waterline region of the suppression pool and HPCI turbine exhaust drain piping to the suppression pool.	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of nuclear pressure relief piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

A representative sample of internal and external surfaces of reactor core isolation cooling (RCIC) piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

Inspections will be performed within the ten years prior to the period of extended operation.

A.1.34 One-Time Inspection – Small-Bore Piping Program

The One-Time Inspection – Small-Bore Piping Program is a new program that will augment ASME Code, Section XI (2001 Edition with 2003 Addenda) requirements and be applicable to small-bore ASME Code Class 1 piping and components with a nominal pipe size diameter less than four inches (NPS 4) and greater than or equal to one inch (NPS 1) in systems that have not experienced cracking of ASME Code Class 1 small-bore piping. Fermi 2 has not experienced cracking of ASME Code Class 1 small-bore piping less than NPS 4 and greater than or equal to NPS 1 due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence. The program can also be used for systems that have experienced cracking but have implemented design changes to effectively mitigate cracking.

This program will provide a one-time volumetric or (socket welds only) opportunistic destructive inspection of ASME Class 1 piping butt weld locations and socket weld locations that are susceptible to cracking. Volumetric examinations will be performed using a demonstrated technique that is capable of detecting the aging effect of cracking in the volume of interest. In the event the opportunity arises to perform a destructive examination of an ASME Class 1 small-bore socket weld that meets the susceptibility criteria, then the program will take credit for two volumetric examinations. The program will include pipes, fittings, branch connections, and full and partial penetration welds.

This program will include a sampling approach. Sample selection will be based on susceptibility to stress corrosion, cyclic loading (including thermal, mechanical, and vibration fatigue), thermal stratification and thermal turbulence, and failure history. Since Fermi 2 will not have more than 30 years of operation at the time of submitting the license renewal application, the inspections include ten percent of the weld population or a maximum of 25 welds of each weld type (e.g., full penetration and socket weld).

The program will include measures to verify that degradation is not occurring, thereby either confirming that there is no need to manage aging-related degradation or validating the effectiveness of any existing program for the period of extended operation. If evidence of cracking is revealed by this one-time inspection, it will be entered into the Corrective Action Program to determine extent of condition, and a follow-up periodic inspection will be managed by a plant-specific program. Flaws or indications are evaluated in accordance with the ASME Code.

The inspection will be performed within the six-year period prior to the period of extended operation.

A.1.35 Periodic Surveillance and Preventive Maintenance Program

There is no corresponding NUREG-1801 program.

The Periodic Surveillance and Preventive Maintenance Program manages aging effects not managed by other aging management programs, including loss of material, fouling, loss of material due to wear, and loss of sealing. Any indication or relevant condition of degradation detected is evaluated. Inspections occur at least once every five years during the period of extended operation.

The Fermi 2 aging management review credits the following inspection activities.

- Visually inspect and manually flex the rubber gasket/seal for reactor building spent fuel storage pool gates to verify no loss of sealing.
- Visually inspect a representative sample of EDG system air coolant, lube oil, and jacket water heat exchanger tubes to manage loss of material due to wear.
- Use visual or other NDE techniques to inspect internal surfaces to manage fouling of the fire water system heat exchanger tubes exposed to raw water.
- Visually inspect a representative sample of CTG system lube oil heat exchanger tubes to manage loss of material due to wear.
- Visually inspect a representative sample of CTG system atomizing air precooler heat exchanger tubes to manage fouling and loss of material due to wear.
- Visually inspect and clean CTG system atomizing air booster compressor suction filter to manage fouling.
- Visually inspect and clean CTG system compressor extraction air filter to manage fouling.
- Use visual or other NDE techniques to inspect containment atmospheric control system recombiner components' internal surfaces to manage loss of material.
- Nonsafety-related systems affecting safety-related systems
    - Visually inspect the internal surface of a representative sample of nuclear boiler system (B21) piping and valve bodies to manage loss of material.

- Perform visual or ultrasonic inspection of a representative sample of the internal surface of fuel pool cooling and cleanup system (G41) abandoned piping to manage loss of material.
- Visually inspect the internal surface of a representative sample of condensate system (N20) tanks and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of heater drains system (N22) piping, thermowells, and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of main turbine generator and auxiliaries system (N30) piping, tanks, and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of condenser and auxiliaries system (N61) piping and valve bodies to manage loss of material.
- Visually inspect the internal surface of process sampling system (P33) chiller and cooler housing to manage loss of material.
- Visually inspect the internal surface of a representative sample of drips, drains and vents system (P95) piping and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of reactor/ auxiliary building HVAC system (T41) piping, strainer housing, tubing, and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of containment atmospheric control system (T48) piping and valve bodies to manage loss of material.

The Periodic Surveillance and Preventive Maintenance Program will be enhanced as follows.

- Revise the Periodic Surveillance and Preventive Maintenance Program procedures as necessary to incorporate the identified activities.

- Revise the Periodic Surveillance and Preventive Maintenance Program procedures to state that the acceptance criterion is no indication of relevant degradation and to incorporate the following:

  - Examples of acceptance criteria for metallic components
    - No excessive corrosion (loss of material).
    - No leakage from or onto internal surfaces (loss of material).
    - No excessive wear (loss of material).

  - Examples of acceptance criteria for elastomeric components
    - Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color.

Enhancements will be implemented prior to the period of extended operation.

A.1.36 Protective Coating Monitoring and Maintenance Program

The Protective Coating Monitoring and Maintenance Program monitors and maintains Service Level I coatings applied to carbon steel and concrete surfaces inside containment (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors). The program addresses accessible coated surfaces inside containment. The Fermi 2 program will be enhanced to meet the technical basis of ASTM D5163-08. With these enhancements, the program provides an effective method to assess coating condition through visual inspections by identifying degraded or damaged coatings and providing a means for repair of identified problem areas.

Service Level I protective coatings are not credited to manage the effects of aging. Proper monitoring and maintenance of protective coatings inside containment ensures operability of post-accident safety systems that rely on water recycled through the containment. The proper monitoring and maintenance of Service Level I coatings ensures there is no coating degradation that would impact safety functions, for example, by clogging emergency core cooling systems suction strainers and possibly causing unacceptable head loss in the system.

The Protective Coating Monitoring and Maintenance Program will be enhanced as follows.

- Revise plant procedures to include in the program Service Level I coating applied to steel and concrete surfaces of the steel containment vessel (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors).
- Revise plant procedures to include information and instructions for monitoring Service Level I coating systems to be used for the inspection of coatings in accordance with guidelines identified in ASTM D5163-08.
- Revise plant procedures to specify the parameters monitored or inspected in accordance with subparagraph 10.2 of ASTM D5163-08.
- Revise plant procedures to establish the inspection frequency in accordance with paragraph 6 of ASTM D5163-08.
- Revise plant procedures to develop an inspection plan and specify inspection methods to be used as identified in accordance with subparagraph 10.1 of ASTM D5163-08.
- Revise plant procedures to specify that the nuclear coating specialist qualification recommendations and duties be as defined in ASTM D7108. As a minimum, qualification of inspection personnel (protective coating surveillance personnel) who perform these inspections shall be as specified in ASTM D4537.
- Revise plant procedures to specify a protective coatings program owner (inspection coordinator and inspection results evaluator) or equivalent to nuclear coating specialist

defined in ASTM D5163-08, is responsible for the overall plant coatings program and has general duties and responsibilities similar to those defined for a nuclear coating specialist in Section 5 of ASTM D7108-05.

- Revise plant procedures to specify that detection of aging effects will include visual inspections of coatings near sumps or screens associated with the emergency core cooling system (ECCS).
- Revise plant procedures to specify instruments and equipment needed for inspection in accordance with subparagraph 10.5 of ASTM D5163-08.
- Revise plant procedures to specify that upon the completion of a planned refuel outage, a coatings outage summary report will be prepared of the coating work performed in Service Level I areas during the outage. The summary report prioritizes repair areas as areas that must be repaired during the same outage or postponed to future outages, keeping the coatings under surveillance during the interim period.
- Revise plant procedures to specify that the last two performance monitoring reports pertaining to the coating systems will be reviewed prior to the inspection or monitoring process.
- Revise plant procedures to describe the characterization, documentation, and testing of defective or deficient coating surface in accordance with subparagraphs 10.2.1 through 10.2.6, 10.3, and 10.4 of ASTM D5163-08.
- Revise plant procedures to specify that the coatings outage summary report will be evaluated and approved by the protective coatings program owner.

Enhancements will be implemented prior to the period of extended operation.

A.1.37 Reactor Head Closure Studs Program

The Reactor Head Closure Studs Program manages cracking due to stress corrosion cracking (SCC) or intergranular stress corrosion cracking (IGSCC) and loss of material due to wear or corrosion for reactor head closure stud bolting (studs, washers, nuts, bushings, and threads in flange) using inservice inspection (ASME Section XI 2001 Edition 2003 Addendum Table IWB-2500-1) and preventive measures to mitigate cracking. The program follows examination and inspection requirements to detect and size cracks and detect loss of material. Acceptance criteria and evaluation of indications are in accordance with ASME Section XI and other requirements specified per 10 CFR 50.55a with NRC-approved alternatives.

Preventive actions include avoiding the use of metal-plated stud bolting, use of an acceptable surface treatment, use of stable lubricants, and use of bolting materials with low susceptibility to stress corrosion cracking. The program uses visual, surface, and volumetric examinations as required by ASME Section XI. The program also relies on recommendations to address reactor head closure studs degradation listed in NUREG-1339 and NRC Regulatory Guide (RG) 1.65.

The reactor vessel studs, nuts, closure washers, and threaded bushings at Fermi 2 are fabricated from SA-540 Grade B23 and B24 carbon steel. RG 1.65, October 1973, identifies that SA-540 Grades B23 and B24, when tempered to a maximum tensile strength of 170 ksi, are relatively immune to SCC. Nevertheless, since the actual yield strength is not known, the aging management review conservatively identified the stud material as susceptible to cracking.

The Reactor Head Closure Studs Program will be enhanced as follows.

- Revise Reactor Head Closure Studs Program procedures to ensure that replacement studs are fabricated from bolting material with actual measured yield strength less than 150 kilo-pounds per square inch.
- Revise Reactor Head Closure Studs Program procedures to include a statement that excludes the use of molybdenum disulfide (MoS_2) on the reactor vessel closure studs and also refers to recommendations in RG 1.65, Rev. 1.

Enhancements will be implemented prior to the period of extended operation.

A.1.38 Reactor Vessel Surveillance Program

The Reactor Vessel Surveillance Program manages reduction of fracture toughness of reactor vessel beltline materials due to neutron irradiation embrittlement and monitors reactor vessel long-term operating conditions that could affect neutron irradiation embrittlement of the reactor vessel using material data and dosimetry. The program includes all reactor vessel beltline materials as defined by 10 CFR 50 Appendix G, Section II.F, and complies with 10 CFR 50, Appendix H for vessel material surveillance.

The objective of the reactor vessel material surveillance program is to provide sufficient material data and dosimetry to (a) monitor irradiation embrittlement at the end of the period of extended operation and (b) determine the need for operating restrictions on the inlet temperature, neutron spectrum, and neutron flux.

The original Fermi 2 reactor vessel surveillance program was designed to monitor reactor vessel beltline materials by testing surveillance capsules withdrawn from the Fermi 2 reactor vessel.

The Fermi 2 reactor vessel surveillance program has been integrated into the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP). The surveillance sample materials remaining in the Fermi 2 reactor pressure vessel (RPV) are maintained as spares for possible future use. The BWRVIP ISP replaces individual plant reactor pressure vessel surveillance capsule programs with representative weld and base materials data from host reactors. Throughout the term of the ISP, the BWRVIP monitors the progress, coordinates future actions such as withdrawal and testing of future capsules and reporting of surveillance capsule test results, and identifies additional program needs. The BWRVIP will identify and implement changes to the program as the need arises. When specific changes are identified to the ISP testing matrix, withdrawal schedule, or testing and reporting of individual capsule results, these modifications will be submitted to the NRC in a timely manner so that appropriate arrangements can be made for implementation.

The integrated surveillance program for the extended period of operation (ISP(E)), based on BWRVIP document BWRVIP-86, Revision 1, has been approved for use by the NRC. BWRVIP-135 provides reactor pressure vessel surveillance data and other technical material information for the plants participating in the ISP and is revised periodically as additional surveillance data is obtained.

The Reactor Vessel Surveillance Program will be enhanced as follows.

- Revise Reactor Vessel Surveillance Program procedures to ensure that new fluence projections through the period of extended operation and the latest vessel beltline adjusted reference temperature (ART) tables are provided to the BWRVIP prior to the period of extended operation.

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

A.1.39 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program

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

Enhancements to this program are included in the enhancements to the Structures Monitoring Program (Section A.1.42).

A.1.40 Selective Leaching Program

The Selective Leaching Program is a new program that will demonstrate the absence of selective leaching in a selected sample of components (i.e., 20 percent of the population with maximum of 25 components) fabricated from gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc or greater than 8 percent aluminum exposed to raw water, treated water, waste water, or soil. A sample population is defined as components with the same material and environment combination. Where practical, the sample population will focus on bounding or leading components most susceptible to aging due to time in service, severity of operating condition, and lowest design margin. The program will include a one-time visual inspection of selected components coupled with hardness measurement or other mechanical examination techniques such as destructive testing, scraping or chipping to determine whether loss of material is occurring due to selective leaching that may affect the ability of a component to perform its intended function during the period of extended operation.

Follow-up of unacceptable inspection findings will include an evaluation using the Corrective Action Program and possible expansion of the inspection sample size and location.

This inspection will be performed within five years prior to the period of extended operation.

A.1.41 Service Water Integrity Program

The Service Water Integrity Program manages loss of material and fouling for safety-related service water system components fabricated from carbon steel, copper alloys, and stainless steel exposed to service water systems as described in the Fermi 2 response to NRC GL 89-13. The program includes (a) surveillance and control techniques to manage effects of biofouling, corrosion, various erosion mechanisms, and silting; (b) tests to verify heat transfer capability of heat exchangers important to safety; (c) routine inspections and maintenance. System walkdowns are performed.

The Service Water Integrity Program will be enhanced as follows.

- Revise Service Water Integrity Program procedures to include inspection to determine if loss of material due to erosion is occurring in the system.
- Revise Service Water Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Enhancements will be implemented prior to the period of extended operation.

A.1.42 Structures Monitoring Program

The Structures Monitoring Program provides for aging management of structures and structural components, including structural bolting, within the scope of license renewal. The program was developed based on guidance in Regulatory Guide (RG) 1.160, Revision 2, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and NUMARC 93-01, Revision 2, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," to satisfy the requirement of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The scope of the Structures Monitoring Program includes structures within the scope of license renewal as delineated in 10 CFR 54.4. The program performs periodic visual examinations to monitor the condition of structures and structural components, including components such as concrete and steel components, structural bolting, component supports, concrete masonry blocks, and other structures such as earthen structures. Inspections are performed at a frequency to ensure there is no loss of intended function between inspections. The program will be enhanced to perform inspections at least once every five years, with provisions for more frequent inspections, to ensure there is no loss of intended function between inspections. The scope of the program also includes the condition monitoring of masonry walls and water-control structures as described in the Masonry Wall Program (Section A.1.25) and in the NRC RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," aging management program (Section A.1.39).

The Structures Monitoring Program is augmented by plant procedures to ensure that the selection of bolting material, installation torque or tension, and the use of lubricants and sealants are appropriate for the intended purpose. These procedures will be enhanced to include the guidance of NUREG-1339 and EPRI TR-104213, NP-5067, and NP-5769 to ensure proper specification of bolting material, lubricant, and installation torque.

The Structures Monitoring Program will be enhanced as follows.

- Revise plant procedures to add the following structures to the program.
  - Condensate storage tank and condensate return tank foundations and retaining barrier
  - CTG-11-1 fuel oil storage tank foundation
  - Independent spent fuel storage installation (ISFSI) rail transfer pad
  - Manholes, handholes and duct banks
  - Shore barrier
  - Transformer and switchyard support structures and foundations
- Revise plant procedures to specify that the following in-scope structures are included in the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program (Section A.1.39):
  - General service water pump house

- Residual heat removal complex
- Shore barrier

- Revise plant procedures to ensure that masonry walls located in in-scope structures are in the scope of the Masonry Wall Program (Section A.1.25).

- Revise plant procedures to include a list of structural components and commodities within the scope of license renewal to be monitored in the program.

- Revise plant procedures to include periodic sampling and chemical analysis of ground water.

- Revise plant procedures to include the following preventive actions:

  - Preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize the proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting.
  - Preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

- Revise plant procedures to include the following parameters to be monitored or inspected:

  - For concrete structures, base inspections on quantitative requirements of industry codes (i.e., ACI 349.3R), standards and guidelines (i.e., ASCE 11) and consideration of industry and plant-specific operating experience.
  - For concrete structures and components, include loss of material, loss of bond, increase in porosity and permeability, loss of strength, and reduction in concrete anchor capacity due to local concrete degradation.
  - For chemical analysis of ground water, monitor pH, chlorides, and sulfates.
  - Monitor gaps between the structural steel supports and masonry walls that could potentially affect wall qualification.

- Revise plant procedures to include the following components to be monitored for the associated parameters:

  - Structural bolting and anchors/fasteners (nuts and bolts) for loss of material, loose or missing nuts and/or bolts, and cracking of concrete around the anchor bolts.
  - Elastomeric vibration isolators and structural sealants for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening).

- Revise plant procedures to provide technical guidance for torque value requirements for specified bolting material subject to plant operating environments.

- Revise plant procedures to include the following for detection of aging effects:

  - Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R.
  - Visual inspection of elastomeric material should be supplemented by feel or touch to detect hardening if performance of the intended function of the elastomeric material is suspect. Include instructions to augment the visual examination of elastomeric material with physical manipulation of at least ten percent of available surface area.
  - Structures will be inspected at least once every five years.
  - Submerged structures will be inspected at least once every five years.
  - If normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring.
  - Sampling and chemical analysis of ground water at least once every five years. The Structures Monitoring Program owner will review the results and evaluate any anomalies and perform trending of the results.
  - Masonry walls will be inspected at least once every five years, with provisions for more frequent inspections in areas where significant aging effects (i.e., missing blocks, cracking, etc.) is observed to ensure there is no loss of intended function between inspections.
  - Inspection of water-control structures should be conducted under the direction of qualified personnel experienced in the investigation, design, construction, and operation of these types of facilities.
  - Inspections of water-control structures on an interval not to exceed five years.
  - Perform special inspections of water-control structures immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls.

- Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.

Enhancements will be implemented prior to the period of extended operation.

A.1.43 Water Chemistry Control – BWR Program

The Water Chemistry Control – BWR Program manages loss of material, cracking, and fouling in components exposed to a treated water environment through periodic monitoring and control of water chemistry. The Water Chemistry Control – BWR Program monitors and controls water chemistry parameters such as pH, chloride, conductivity, and sulfate. EPRI Report 1016579 is used to provide guidance.

The One-Time Inspection Program utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – BWR Program has been effective at managing aging effects. The representative sample includes low flow and stagnant areas.

A.1.44 Water Chemistry Control – Closed Treated Water Systems Program

The Water Chemistry Control – Closed Treated Water Systems Program manages loss of material, cracking, and fouling in components exposed to a closed treated water environment, through monitoring and control of water chemistry, including the use of corrosion inhibitors, chemical testing, and visual inspections of internal surface condition. The EPRI Closed Cycle Cooling Guideline (1007820), industry guidance, and vendor recommendations are used to delineate the program.

The Water Chemistry Control – Closed Treated Water Systems Program will be enhanced as follows.

- Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to include the following systems.
  - Process sampling system roughing cooler
  - CCHVAC chill water system
- Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to provide chemical treatment including a corrosion inhibitor for the following systems in accordance with industry guidelines and vendor recommendations.
  - Process sampling system roughing cooler
  - CCHVAC chill water system
- Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to specify water chemistry parameters monitored and the acceptable range of values for these parameters in accordance with EPRI 1007820, industry guidance, or vendor recommendations.
- Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to inspect accessible components whenever a closed treated water system boundary is opened. Ensure that a representative sample of piping and components is inspected at a

frequency of at least once every ten years. These inspections will be conducted in accordance with applicable ASME Code requirements, industry standards, or other plant-specific inspection guidance by qualified personnel using procedures that are capable of detecting corrosion, fouling, or cracking.

If visual examination identifies adverse conditions, then additional examinations, including ultrasonic testing, are conducted. Components inspected will be those with the highest likelihood of corrosion, fouling, or cracking. A representative sample is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components.

Perform treated water sampling and analysis of the closed treated water systems per industry standards and in no case greater than quarterly unless justified with an additional analysis.

Enhancements will be implemented prior to the period of extended operation.

A.2 EVALUATION OF TIME-LIMITED AGING ANALYSES

In accordance with 10 CFR 54.21(c), an application for a renewed license requires an evaluation of time-limited aging analyses for the period of extended operation. The following time-limited aging analyses have been identified and evaluated to meet this requirement.

A.2.1 Reactor Vessel Neutron Embrittlement

The reactor vessel neutron embrittlement time-limited aging analyses, including consideration for measurement uncertainty recapture/thermal power optimization (MUR/TPO) (Refs. A.3-3, A.3-4), either have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) or will be managed for the period of extended operation in accordance with 10 CFR 54.24(c)(1)(iii) as summarized below.

Based on the plant operating history, a projected value of 52 EFPY is used to evaluate reactor vessel neutron embrittlement time-limited aging analyses (TLAAs).

A.2.1.1 Reactor Vessel Fluence

Fluence is calculated based on a time-limited assumption defined by the operating term. Therefore, analyses that evaluate reactor vessel neutron embrittlement based on calculated fluence are time-limited aging analyses.

The reactor vessel fluence has been calculated to include higher power level beginning with cycle 17, when the reactor power increased due to the MUR/TPO uprate. The peak neutron fluence projected for 52 EFPY is 1.43E+18 n/cm^2 at the vessel inner surface. The high energy (> 1 MeV) neutron fluence for the welds and shells of the reactor pressure vessel (RPV) beltline region was determined using the General Electric-Hitachi (GEH) method for neutron flux calculation documented in report NEDC-32983P-A. The method adheres to the guidance prescribed in Regulatory Guide (RG) 1.190.

The neutron fluence calculation results are inputs into fracture toughness analyses. The effects of aging due to neutron irradiation are considered in the neutron embrittlement TLAAs for the reactor vessel (e.g., upper-shelf energy analysis and P-T limits analysis). The neutron fluence analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.1.2 Adjusted Reference Temperature

A key parameter that characterizes the fracture toughness of a material is the reference nil-ductility transition temperature (RT_{NDT}). The effects of neutron radiation on RT_{NDT} are reflected in the reference temperature change (ΔRT_{NDT}). The adjusted reference temperature (ART) is calculated by adding ΔRT_{NDT} to initial RT_{NDT} with an appropriate margin for uncertainties (ΔRT_{NDT} + RT_{NDT} + margin) as defined by RG 1.99 Revision 2.

The method used for the evaluation of the 52 EFPY ART is the same method used by GEH for the MUR/TPO ART evaluation. The ART values for all beltline materials are calculated using fluence values determined with an NRC-approved method that complies with RG 1.190. All projected values are well below the 200°F suggested in Section C.3 of RG 1.99 as an acceptable nominal value of ART for the end of life. The TLAA for ART has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). Formal revisions of affected analyses are completed as part of the established process for generation of updated P-T operating limits.

A.2.1.3 Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires that the reactor vessel remain within established pressure-temperature (P-T) limits during boltup, hydro-test, pressure tests, normal operation, and anticipated operational occurrences. These limits are calculated using materials and fluence data, including data obtained through the Reactor Vessel Surveillance Program (Section A.1.38).

The P-T limit curves will continue to be updated, as required by Appendix G of 10 CFR Part 50, assuring that limits remain valid through the period of extended operation.

The time-limited aging analyses for reactor vessel pressure-temperature limits will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.1.4 Upper Shelf Energy

Upper-shelf energy (USE) is evaluated for beltline materials. Fracture toughness criteria in 10 CFR 50 Appendix G require that beltline materials maintain USE no less than 50 ft-lb during operation of the reactor. The 52 EFPY USE values for the beltline materials were determined using methods consistent with RG 1.99. The determination used the peak ¼T fluence.

The time-limited aging analysis for upper shelf energy has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.1.5 Reactor Vessel Circumferential Weld Inspection Relief

The reactor pressure vessel (RPV) circumferential weld parameters at 52 EFPY will remain within the NRC's (64 EFPY) bounding parameters from the BWRVIP-05 SER. The fact that the values projected to the end of the period of extended operation are less than the 64 EFPY value provided by the NRC leads to the conclusion that the RPV conditional failure probability is less than the conditional failure probability of the NRC analysis. As such, the conditional probability of failure for circumferential welds remains below that determined during the NRC's final safety evaluation of BWRVIP-05.

The reactor vessel circumferential weld inspection relief for the period of extended operation will be submitted to the NRC in accordance with 10 CFR 50.55(a). The effects of aging associated with the time-limited aging analysis for reactor vessel circumferential weld inspection relief will be managed in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.1.6 Reactor Vessel Axial Weld Failure Probability

The NRC SER for BWRVIP-74-A evaluated the failure frequency of axially oriented welds in BWR reactor vessels. Applicants for license renewal must evaluate axially oriented RPV welds to show that their failure frequency remains below the value calculated in the BWRVIP-74 SER. The SER states that an acceptable way to do this is to show that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in the SER.

The projected 52 EFPY Fermi 2 mean ART is less than the bounding value shown in the NRC SER for BWRVIP-74. The reactor vessel axial weld TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.1.7 Reactor Pressure Vessel Core Reflood Thermal Shock Analysis

General Electric Report NEDO-10029 is referenced in UFSAR Section A.1.2 and Table 1.6-1. NEDO-10029 addressed the concern for brittle fracture of the reactor pressure vessel due to reflood following a postulated loss of coolant accident (LOCA). The thermal shock analysis documented in NEDO-10029 assumed a design basis recirculation line break LOCA followed by a low pressure coolant injection, accounting for the full effects of neutron embrittlement at the end of 40 years. Because this analysis bounded only 40 years of operation, reflood thermal shock of the reactor pressure vessel has been identified as a TLAA for Fermi 2 requiring evaluation for the period of extended operation.

A later analysis of the BWR vessels was developed in 1979. The analysis shows that when the peak stress intensity occurs at approximately 300 seconds after the LOCA, the temperature of the vessel wall at 1.5 inches deep is approximately 400°F.

The maximum ART value calculated for the Fermi 2 RPV beltline material is 102°F. Using the equation for fracture toughness K_{IC} presented in Appendix A of ASME Section XI and the maximum ART value, the material reaches upper shelf at 206.25°F, which is well below the minimum 400°F temperature predicted for the thermal shock event at the time of peak stress intensity. Therefore, the revised analysis has projected the TLAA through the period of extended operation. The reactor pressure vessel core reflood thermal shock TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.2.2 Metal Fatigue

A.2.2.1 Class 1 Metal Fatigue Analyses

Fatigue evaluations were performed in the design of the Fermi 2 Class 1 components. Class 1 fatigue evaluations are contained in analyses and stress reports, and because they are based on a number of transient cycles assumed for a 40-year operating term, these evaluations are considered time-limited aging analyses.

The Fatigue Monitoring Program (Section A.1.17) tracks transient cycles and requires corrective actions if the numbers of cycles approach analyzed values. The Fatigue Monitoring Program will manage the effects of aging due to fatigue in accordance with 10 CFR 54.21(c)(1)(iii).

The following provides additional information for specific Class 1 components.

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. Fatigue evaluations for the reactor vessel were performed as part of the vessel design.

Fermi 2 monitors transient cycles using the Fatigue Monitoring Program (Section A.1.17) and assures that action is taken if 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 vessel in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Pressure Vessel Feedwater Nozzle

As described in UFSAR Section 5.2.1.20, Fermi 2 installed a feedwater sparger and thermal sleeve prior to plant operation to eliminate thermal fatigue concerns on the feedwater nozzle. The vessel was manufactured with unclad feedwater nozzles, so no cladding removal was necessary. The inner thermal sleeve is the feed pipe for the sparger and is sealed against the safe-end with a piston ring. The inner thermal sleeve is welded to the sparger forged tee. As described in UFSAR Section 5.2.1.20, the Fermi 2 feedwater sparger and thermal sleeve design conforms to NUREG-0619.

As a part of the NUREG-0619 review, a plant-specific feedwater nozzle fracture mechanics assessment was completed. The projected number of startup/shutdowns plus scrams is less than the total cycles utilized in this analysis. Therefore, the analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The analysis of the feedwater nozzle includes fatigue from potential rapid cycling behind the thermal sleeves. The feedwater nozzle has fatigue usage contribution from rapid cycling that is part of the total fatigue usage for that location. The usage is calculated based on time and feedwater temperature in order to include the rapid cycling effect.

The effects of fatigue on the feedwater nozzles will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Pressure Vessel Internals

A reactor vessel general assembly drawing is shown in UFSAR Figure 4.5-1, and a cutaway drawing is shown in UFSAR Figure 5.4-1. The Fermi 2 reactor pressure vessel internals are not ASME code pressure boundary components. ASME analyses were completed for some RVI locations. Fermi 2 will monitor transient cycles using the Fatigue Monitoring Program (Section A.1.17) and assure that action is taken before the numbers of accrued cycles exceed their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor vessel internals in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Recirculation Pumps

As identified in UFSAR Table 3.2-1, the reactor recirculation pumps were designed to the 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 Fatigue Monitoring Program (Section A.1.17) will manage the effects of aging due to fatigue on the reactor recirculation pumps in accordance with 10 CFR 54.21(c)(1)(iii).

Class 1 Piping

UFSAR Table 3.2-1 provides a summary of the safety classes for the principal structures, systems, and components of the plant. Components of the reactor coolant pressure boundary whose failure could cause a loss of reactor coolant at a rate in excess of the normal makeup system capability are Class 1 components. Detailed fatigue analyses were generated to analyze multiple locations on each system within the Class 1 boundary.

The Fatigue Monitoring Program (Section A.1.17) will monitor the numbers of cycles incurred to assure that action is taken if the numbers approach the values analyzed. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the Class 1 piping in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.2.2 <u>Non-Class 1 Metal Fatigue Analyses</u>

UFSAR Table 3.2-1 provides a summary of the safety classes for the principal structures, systems, and components of the plant. As identified in UFSAR Table 3.2-1, the non-Class 1 piping within the scope of license renewal is built to ASME III or ANSI B31.1.

The design of ASME III Code Class 2 and 3 or ANSI B31.1 piping systems incorporates a stress range reduction factor for piping design with respect to thermal stresses. In general, a stress range reduction factor of 1.0 in the stress analyses applies for up to 7000 thermal cycles. Fermi 2 evaluated the validity of this assumption for 60 years of plant operation. The results of this evaluation indicate that the 7000 thermal cycle assumption will not be exceeded for 60 years of operation. Therefore, the non-Class 1 piping stress calculations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Non-Class 1 components other than piping require fatigue analyses if they were built to a section of the code such as ASME Section III, NC-3200 or ASME Section VIII, Division 2. A review of the non-Class 1 components identified non-Class 1 fatigue analysis applicable to expansion joints. Fatigue analyses were identified for expansion joints that assumed a bounding number of cycles. These expansion joint fatigue analyses are treated as time-limited aging analyses. Evaluation of these expansion joint analyses determined the number of analyzed cycles was adequate for 60 years of operation. Therefore, these non-Class 1 expansion joint TLAAs are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.2.3 <u>Effects of Reactor Water Environment on Fatigue Life</u>

NUREG/CR-6260 addresses the application of environmental correction factors to fatigue analyses (cumulative usage factors [CUFs]) and identifies locations of interest for consideration of environmental effects. NUREG/CR-6260 identified the following component locations to be the most sensitive to environmental effects for General Electric plants.

(1) Reactor vessel shell and lower head

(2) Reactor vessel feedwater nozzle

(3) Reactor recirculation piping (including inlet and outlet nozzles)

(4) Core spray line reactor vessel nozzles and associated Class 1 piping

(5) Residual heat removal nozzles and associated Class 1 piping

(6) Feedwater line Class 1 piping

Fermi 2 performed a screening evaluation of these six locations using the guidance provided in NUREG-1801, Revision 2. This screening has determined there are locations that, when accounting for environmental effects, have projected usage factors greater than 1.0. Fermi 2 will update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment prior to the period of extended operation. This includes applying the appropriate F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). Fermi 2 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. Environmental effects on fatigue for these critical components will be evaluated using one of the following sets of formulae:

- Carbon and low alloy steels
  - Those provided in NUREG/CR-6583, using the applicable ASME Section III fatigue design curve.
  - Those provided in Appendix A of NUREG/CR-6909, using either the applicable ASME Section III fatigue design curve or the fatigue design curve for carbon and low alloy steel provided in NUREG/CR-6909 (Figures A.1 and A.2, respectively, and Table A.1).
  - An NRC-approved alternative.
- Austenitic stainless steels
  - Those provided in NUREG/CR-5704, using the applicable ASME Section III fatigue design curve.
  - Those provided in NUREG/CR-6909, using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).
  - An NRC-approved alternative.
- Nickel alloys
  - Those provided in NUREG/CR-6909, using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).
  - An NRC-approved alternative.

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

A.2.3 Environmental Qualification of Electrical Components

All operating plants must meet the requirements of 10 CFR 50.49, which defines the scope of electrical components to be included in a program for qualifying electric equipment important to safety (EQ program) and also sets forth requirements for an EQ program. Qualification is established for the environmental and service conditions expected for normal plant operation and also those conditions postulated for plant accidents. A record of qualification for in-scope components must be prepared and maintained in auditable form. Equipment qualification evaluations for EQ components that result in a qualification of at least 40 years, but less than 60 years, are considered TLAAs for license renewal.

The Fermi 2 Environmental Qualification (EQ) of Electric Components Program (EQ Program) (Section A.1.15) manages component thermal, radiation, and cyclical aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the limitations established in the evaluation. The Fermi 2 EQ Program ensures that EQ components are maintained in accordance with their qualification bases.

The Fermi 2 EQ Program is an existing program established to meet Fermi 2 commitments for 10 CFR 50.49. The program is consistent with NUREG-1801, Section X.E1, "Environmental Qualification (EQ) of Electric Components." The Fermi 2 EQ Program will manage the effects of aging on the intended function(s) of EQ components that are the subject of EQ TLAAs for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.4 Fatigue of Primary Containment, Attached Piping, and Components

As described in UFSAR Section 3.8, the primary containment (a Mark I containment) is a leak-tight steel-plate containment vessel consisting of a light-bulb-shaped drywell and a torus-shaped suppression chamber. The Fermi 2 analysis is documented in the Plant Unique Analysis Report (PUAR) for Fermi 2. Fermi 2 will manage the aging effects due to fatigue using the Fatigue Monitoring Program (Section A.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

The vent line bellows were qualified for bellows expansion from the drywell and torus temperature increase following an accident or from earthquakes. The bellows remain qualified for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Fermi 2 has a refueling bellows attached to the vessel near the reactor vessel flange and a drywell seal bellows outside of the drywell shell. These bellows remain qualified for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Fermi 2 has penetration bellows at the traversing incore probe (TIP) penetrations. The fatigue analysis determined the bellows were qualified for many more cycles than they are expected to experience. Therefore, the bellows remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

As described in UFSAR Section 3.8.2.1.3.1, sleeved penetration assemblies with bellows consist of the process pipe, guard pipe, penetration sleeve bellows, and flued head. For Class 1 piping, the design of the flued head meets ASME III Class 1 requirements, which specify a fatigue analysis that determines the cumulative usage factor for the flued head. Fermi 2 will manage the aging effects due to fatigue of these penetrations using the Fatigue Monitoring Program (Section A.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

The sleeved penetration assembly bellows were determined to be capable of handling the movement from many more cycles than are projected. The sleeved penetration assembly bellows analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.5 Other Plant-Specific TLAAs

A.2.5.1 Erosion of the Main Steam Line Flow Restrictors

UFSAR Section 5.5.4.4 states that the main steam flow restrictors are fabricated from stainless steel and that only very slow erosion will occur with time. The section later postulates that even with an erosion rate of 0.004 inches per year, the increase in choked flow after 40 years would be no more than 5 percent. Analysis of the erosion rate is evaluated as a TLAA.

DTE Electric evaluated the erosion-corrosion rate for the main steam flow restrictors. This evaluation considered the specific material of the Fermi 2 flow restrictors and determined the expected erosion-corrosion rate when operating at the velocities that would be present following an extended power uprate, which is a greater velocity than anticipated following the MUR/TPO uprate. The evaluation determined that the expected erosion-corrosion rate would be much less than the conservative erosion rate provided in the UFSAR. Assuming the expected erosion-corrosion rate for 60 years of operation, the increase in restrictor-choked flow rate will remain no more than five percent as specified in UFSAR Section 5.5.4.4.

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

A.2.5.2 Determination of High-Energy Line Break Locations

UFSAR Sections 3.6.1 and 3.6.2 state that the method used to determine the intermediate locations of pipe breaks in high-energy lines includes an evaluation based on CUFs being less than 0.1 if other stress criteria are also met.

Design criteria for piping between the primary containment and outboard isolation valves provide for maximum stresses considering all normal and upset conditions as calculated by the equations in the ASME Boiler & Pressure Vessel Code Section III Paragraph NB-3653. As identified in UFSAR Section 3.6.2.1.2.2, pipe breaks were not postulated in the high energy piping between the containment penetration and outboard isolation valves since the piping was conservatively designed and restrained. The calculated CUFs for containment penetration piping were also limited to values less than 0.1 if equation 10 of NB-3653 exceeds 2.4 S_m.

The CUFs, as calculated in the design fatigue analyses, are based on the design transients assumed for the original 40-year life of the plant; therefore, the CUF analyses used in the selection of postulated high-energy line break locations are considered TLAAs.

The Fatigue Monitoring Program (Section A.1.17) identifies when the transients affecting high-energy piping are approaching their analyzed numbers of cycles.

DTE Electric will manage the effects of aging associated with the fatigue analyses used in the selection of postulated high-energy line break locations using the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.5.3 Jet Pump Auxiliary Spring Wedge Assembly

Auxiliary spring wedges have been installed on selected jet pumps at Fermi 2. 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 the projected neutron fluence for wedge 1 slightly exceeds 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.

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

A.2.5.4 Jet Pump Slip Joint Repair Clamps

The jet pump slip joint repair clamp is connected to the diffuser and the mixer. The clamp is installed with a preload that may be relaxed due to neutron fluence. The analysis that evaluated relaxation of the slip joint repair clamp is a TLAA.

To evaluate the TLAA, a fluence analysis including the increased fluence due to the MUR/TPO was performed to determine the fluence at the installed positions on the jet pumps including

52 EFPY. It was determined the neutron irradiation does not impact the amount of expected relaxation. The original relaxation value remains valid for 52 EFPY of operation and the stress report results remain applicable for the period of extended operation.

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

A.2.5.5 Flaw Evaluations for the Reactor Vessel

During refueling outage 9 (RF9) in 2003, new ASME Section XI, Appendix VIII qualified ultrasonic examination procedures were used for the first time on reactor pressure vessel welds. These new techniques employed greatly improved flaw detection and sizing methods and detected several reactor vessel flaws. A reexamination in RF12 used the phased array technique and identified flaws at two additional locations.

A fracture mechanics evaluation was performed to determine the acceptability of the reactor vessel flaw indications. The analysis evaluated the bounding flaw location for consideration of the pressure-temperature analysis. The analysis determined the indications are acceptable for 52 EFPY with consideration of the effects of MUR/TPO.

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

A.2.5.6 Main Steam Bypass Lines Cumulative Operating Time

A flaw evaluation concluded that the bypass lines are acceptable for safe operation when operated within the 100 day constraint. The cumulative time the main steam bypass lines are operated with the bypass valves between 30 and 45 percent open will be reported annually. A cumulative value of 100 days is not to be exceeded without prior NRC notification.

Fermi 2 will manage the main steam bypass valves' cumulative usage time using the Fatigue Monitoring Program (Section A.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.5.7 Crane (Heavy Load) Cycles

UFSAR Section 9.1.4.2.2 states that the reactor building overhead crane meets the structural guidelines of Crane Manufacturers Association of America (CMAA) Specification No. 70. CMAA-70 identifies an allowable stress range based on joint category and service class. The definition of service class considers the load class and the load cycles expected on the crane. The lowest range of cycles in CMAA-70 is 20,000 to 100,000 for Class A cranes; therefore, the analysis associated with the CMAA-70 lift cycle limit is considered a TLAA.

It is estimated that the number of lifts for the reactor building overhead crane will remain below the 100,000 cycles established in CMAA-70 for a Class A service hoist.

Therefore, the evaluation of lift cycles for the reactor building crane remains valid for the period of extended operation consistent with 10 CFR 54.21(c)(1)(i).

A.3 REFERENCES

A.3-1 [Fermi 2 License Renewal Application—later]

A.3-2 [NRC Safety Evaluation Report for Fermi 2 License Renewal—later]

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).

A.4 LICENSE RENEWAL COMMITMENT LIST

No.	Program or Activity	Commitment	Implementation Schedule	Source
1	Operating Experience Review	DTE will make the following changes to the process for operating experience review (OER). a. Procedures will be revised to add an aging type code to Corrective Action Program documents that describe either plant conditions related to aging or industry operating experience related to aging. b. Procedures will be revised to provide for training of personnel responsible for submitting, screening, assigning, evaluating, or otherwise processing plant-specific and industry operating experience concerning age-related degradation and aging management, as well as for personnel responsible for implementing AMPs, based on the complexity of the job performance requirements and assigned responsibilities. c. Procedures will be revised to specify that evaluations of operating experience concerning age-related degradation will include consideration of the affected systems, structures or components, the environments, materials, aging effects, aging mechanisms, and aging management programs.	Within 6 months after issuance of the renewed license.	A.1
2	Self-Assessment	DTE currently performs periodic self-assessments on many aging management programs. DTE will enhance the Fermi 2 self-assessment process to provide for periodic evaluation of the effectiveness of each aging management program described in the UFSAR supplement. For new aging management programs, the first evaluation will be performed within five years of implementing the program.	Within 5 years of implementing the program for new programs.	A.1

No.	Program or Activity	Commitment	Implementation Schedule	Source
3	Aboveground Metallic Tanks	Implement new Aboveground Metallic Tanks Program that will manage loss of material and cracking for outdoor tanks within the scope of license renewal that are sited on soil or concrete. CST internal inspections will be conducted in accordance with Table 4a of LR-ISG-2012-02; internal inspections of the CTG fuel oil tank will be conducted in accordance with NUREG-1801, XI.M30. This program will also manage the bottom surfaces of both in-scope aboveground metallic tanks.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.1
4	Bolting Integrity	Enhance Bolting Integrity Program as follows: a. Revise Bolting Integrity Program procedures to ensure consideration of actual yield strength when procuring bolting material. If procured, closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking. b. Revise Bolting Integrity Program procedures to state that accessible bolting for safety-related pressure-retaining components is inspected for leakage, loss of material, cracking, and loss of preload/loss of prestress. Closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking. c. Revise Bolting Integrity Program procedures to (1) implement applicable recommendations for pressure boundary bolting in NUREG-1339, EPRI NP-5769, and EPRI TR-104213; (2) state both ASME Code class accessible bolted connections and non-ASME Code class accessible bolted connections are inspected at least once per refueling cycle; and (3) include volumetric examination per ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, for closure bolting with actual yield strength greater than or equal to 150 ksi regardless of code classification. (continued)	Prior to September 20, 2024.	A.1.2

No.	Program or Activity	Commitment	Implementation Schedule	Source
4 (cont)		d. Revise Bolting Integrity Program procedures to inspect RHRSW, EESW, and EDGSW systems' pump and valve bolting submerged in the RHRSW reservoir at least once every refueling outage. e. Revise Bolting Integrity Program procedures to include the additional guidance and recommendations of EPRI NP-5769 for replacement of ASME pressure-retaining bolts and the guidance provided in EPRI TR-104213 for the replacement of other pressure-retaining bolts. f. Revise Bolting Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.		
5	Boraflex Monitoring	Enhance Boraflex Monitoring Program as follows: a. Revise Boraflex Monitoring Program procedures to include areal B-10 density measurement testing of the spent fuel storage racks, such as BADGER testing, at a frequency of at least once every five years.	Prior to September 20, 2024.	A.1.3
6	Buried and Underground Piping	Implement new Buried and Underground Piping Program that will manage the effects of aging on the external surfaces of buried and underground piping within the scope of license renewal. 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 4a of NUREG 1801, XI.M41, is taken based on a lack of soil corrosivity.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.4

No.	Program or Activity	Commitment	Implementation Schedule	Source
7	BWR Vessel Internals	Enhance BWR Vessel Internals Program as follows: a. The susceptibility to neutron or thermal embrittlement for reactor vessel internal components composed of CASS and X-750 alloy will be evaluated. b. BWR Vessel Internals Program procedures will be revised as follows. Portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility, neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions) will be inspected, using an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or within five years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size for the initial inspection of susceptible components will be 100 percent of the accessible component population, excluding components that may be in compression during normal operations. c. BWR Vessel Internals Program procedures will be revised as follows. In accordance with an applicant action item for BWRVIP-25 safety evaluation: (a) install core plate wedges prior to the period of extended operation, or (b) complete a plant-specific analysis that justifies no inspections are required or to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25 and submit the inspection plan, along with the acceptance criteria and justification for the inspection plan, to the NRC two years prior to the period of extended operation.	Perform initial inspection either prior to March 20, 2025 or before March 20, 2030. Submit inspection plan to NRC prior to March 20, 2023. Remaining activities: Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.10

No.	Program or Activity	Commitment	Implementation Schedule	Source
8	Compressed Air Monitoring	Enhance Compressed Air Monitoring Program as follows: a. Revise Compressed Air Monitoring Program procedures to periodically sample, test, and monitor moisture and corrosive contaminants to verify parameters are within acceptable limits in the EDG starting air system to mitigate aging effects such as loss of material due to corrosion. b. Revise Compressed Air Monitoring Program procedures to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters. In addition, include in the Compressed Air Monitoring Program procedures the applicable provisions recommended in EPRI NP-7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17 for air system contaminants, inspection frequency, inspection methods, and acceptance criteria for components subject to aging management review that are exposed to compressed air and components in the emergency diesel generator (EDG) starting air system and control air system.	Prior to September 20, 2024.	A.1.11
9	Containment Inservice Inspection (CII) – IWE	Enhance CII-IWE Program as follows: a. Revise plant procedures to require inspection of the sand pocket drain lines prior to the period of extended operation. b. Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting. c. Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." (continued)	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.12

No.	Program or Activity	Commitment	Implementation Schedule	Source
9 (cont)		d. Revise plant procedures to specify that inspections of the sand pocket drain lines will monitor the internal condition of the drain lines. e. Revise plant procedures to require visual inspection of sand pocket drains to ensure there is no evidence of blockage. f. Revise plant procedures to determine drywell shell thickness in the sand pocket areas before the period of extended operation. From the results, develop a corrosion rate to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation. g. Revise plant procedures to require corrective actions should moisture be detected or suspected in the inaccessible area on the exterior of the drywell shell, including: • Identify surfaces requiring augmented inspections for the period of extended operation in accordance with Subsection IWE-1240, as identified in Table IWE-2500-1, Examination Category E-C. • Use examination methods that are in accordance with Subsection IWE-2500. • Demonstrate through use of augmented inspections performed in accordance with Subsection IWE that corrosion is not occurring or that corrosion is progressing so slowly that the degradation will not jeopardize the intended function of the drywell shell through the period of extended operation.		

No.	Program or Activity	Commitment	Implementation Schedule	Source
10	Diesel Fuel Monitoring	Enhance Diesel Fuel Monitoring Program as follows: a. Revise Diesel Fuel Monitoring Program procedures to monitor and trend water and sediment, particulates, and levels of microbiological organisms in the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and combustion turbine generator (CTG) fuel oil tank quarterly. In addition, revise program procedures to state that biocides or corrosion inhibitors may be added as a preventive measure or are added if periodic testing indicates biological activity or evidence of corrosion, respectively. b. Revise the Diesel Fuel Monitoring Program procedures to include a ten-year periodic cleaning and internal visual inspection of the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank with the following instructions. The cleanings and internal inspections will be performed at least once during the ten-year period prior to the period of extended operation and at succeeding ten-year intervals. If visual inspection is not possible, perform a volumetric inspection. If evidence of degradation is observed during visual inspection, perform a volumetric examination of the affected area.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.14
11	External Surfaces Monitoring	Enhance External Surfaces Monitoring Program as follows: a. Revise External Surfaces Monitoring Program procedures to clarify that periodic inspections will be performed of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2). (continued)	Prior to September 20, 2024.	A.1.16

No.	Program or Activity	Commitment	Implementation Schedule	Source
11 (cont)		b. Revise External Surfaces Monitoring Program procedures to inspect 100 percent of accessible components at least once per refueling cycle and to ensure required walkdowns include instructions to inspect for the following related to metallic components: • Corrosion (loss of material). • Leakage from or onto external surfaces (loss of material). • Worn, flaking, or oxide-coated surfaces (loss of material). • Corrosion stains on thermal insulation (loss of material). • Protective coating degradation (cracking, flaking, and blistering). • Leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides (cracking). c. Revise External Surfaces Monitoring Program procedures to include instructions for monitoring aging effects for flexible polymeric components through physical manipulations of the material, with a sample size for manipulation of at least ten percent of the available surface area. Inspect accessible surfaces for the following: • Surface cracking, crazing, scuffing, dimensional changes (e.g., ballooning and necking). • Discoloration. • Exposure of internal reinforcement for reinforced elastomers. • Hardening as evidence by loss of suppleness during manipulation where the component and material are appropriate to manipulation. • Shrinkage, loss of strength. (continued)		

No.	Program or Activity	Commitment	Implementation Schedule	Source
11 (cont)		d. Revise External Surfaces Monitoring Program procedures to ensure surfaces that are insulated will be inspected when the external surface is exposed (i.e., during maintenance). e. Revise External Surfaces Monitoring Program procedures to include acceptance criteria for the parameters observed. • Metals should not have any indications of relevant degradation. • Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color. • Rigid polymers should have no erosion, cracking, crazing or chalking. f. Revise External Surfaces Monitoring Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.		
12	Fatigue Monitoring	Enhance Fatigue Monitoring Program as follows: a. Revise Fatigue Monitoring Program procedures to monitor and track critical thermal and pressure transients for components that have been identified to have a fatigue TLAA. (continued)	Part (b): At least two years prior to March 20, 2025. Remainder: Prior to September 20, 2024.	A.1.17

No.	Program or Activity	Commitment	Implementation Schedule	Source
12 (cont)		b. Develop environmentally assisted fatigue (EAF) usage calculations that consider the effects of the reactor water environment for a set of sample reactor coolant system components. This sample set will include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they are found to be more limiting than those considered in NUREG/CR-6260. Environmental correction factors will be determined using formulae consistent with those recommended in NUREG-1801, X.M1. c. Revise Fatigue Monitoring Program procedures to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified. For components with assumed minimal cycle counts, ensure that exemption assumptions are not exceeded. 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.		

No.	Program or Activity	Commitment	Implementation Schedule	Source
13	Fire Protection	Enhance Fire Protection Program as follows: a. Revise Fire Protection Program procedures perform visual inspections to manage loss of material of the Halon and CO_2 fire suppression system. b. Revise Fire Protection Program procedures to require visual inspections of in-scope– • Fire wrap and fire stop materials constructed of fibersil cloth, cerafoam, kaowool, thermolag, flamemastic, and pyrocrete for loss of material, change in material properties, cracking/delamination, separation, increased hardness, shrinkage, and loss of strength. • Carbon steel penetration sleeves for loss of material. • Steel framing, roof decking, and floor decking for loss of material. • Concrete fire barriers including manways, manhole covers, handholes, and roof slabs for loss of material and cracking. • Railroad bay airlock doors for loss of material. Inspections are performed at a frequency in accordance with the NRC-approved fire protection program or at least once every refueling cycle.	Prior to September 20, 2024.	A.1.18
14	Fire Water System	Enhance Fire Water System Program as follows: a. Revise Fire Water System Program procedures to include periodic visual inspection of fire water system internals surface condition for evidence of loss of material. (continued)	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.19

No.	Program or Activity	Commitment	Implementation Schedule	Source
14 (cont)		b. Revise Fire Water System Program procedures to include one of the following inspection options. (1) Wall thickness evaluations of fire protection piping using nonintrusive techniques (e.g., volumetric testing) to identify evidence of loss of material will be performed prior to the period of extended operation and periodically thereafter. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function. OR (2) A visual inspection of the internal surface condition of a representative sample of fire protection piping will be performed. The visual inspections can be opportunistic or planned as needed to obtain a representative sample prior to the period of extended operation. The frequency of inspections during the period of extended operation will be determined through an engineering evaluation of the results of previous inspections of fire water piping. c. Revise Fire Water System Program procedures to include testing or replacement of sprinkler heads. If testing is chosen, a representative sample of sprinkler heads will be tested before the end of the 50-year sprinkler head service life and at ten-year intervals thereafter during the extended period of operation. NFPA-25 defines a representative sample of sprinklers. If replacement of the sprinkler heads is chosen, all sprinklers that have been in service for 50 years will be replaced. (continued)		

No.	Program or Activity	Commitment	Implementation Schedule	Source
14 (cont)		d. Revise Fire Water System Program procedures to include inspection of fire water system internals for no unacceptable signs of degradation observed during non-intrusive or visual inspection of components and no biofouling found in the sprinkler systems that could cause corrosion in the sprinklers.		
15	Flow-Accelerated Corrosion	Enhance Flow-Accelerated Corrosion Program as follows: a. Revise procedures to indicate that the FAC Program also manages loss of material due to erosion mechanisms of cavitation, flashing, liquid droplet impingement, and solid particle erosion for any material in treated water or steam environments. Include in program procedures a susceptibility review based on internal operating experience, external operating experience, EPRI TR-1011231, and NUREG/CR-6031. Piping subject to erosive conditions is not excluded from inspections, even if it has been replaced with FAC-resistant material. Periodic wall thickness measurements of such piping should continue until the effectiveness of corrective actions is assured. b. Revise FAC Program procedures to specify that downstream components are monitored closely for wall thinning when susceptible upstream components are replaced with resistant materials.	Prior to September 20, 2024.	A.1.20
16	Inservice Inspection (ISI) – IWF	Enhance ISI-IWF Program as follows: a. Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. (continued)	Prior to September 20, 2024.	A.1.22

No.	Program or Activity	Commitment	Implementation Schedule	Source
16 (cont)		b. Revise plant procedures to require structural bolting replacement and maintenance activities to include appropriate preload and proper tightening (torque or tension) as recommended in EPRI documents, ASTM standards, AISC Specifications, as applicable. c. Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." d. Revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts or bolts, and cracking of concrete around the anchor bolts. e. Revise plant procedures to identify the following unacceptable conditions: • Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support. • Cracked or sheared bolts, including high-strength bolts, and anchors.		
17	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (OVHLL)	Enhance OVHLL Program as follows: a. Revise plant procedures to specify the monitoring of rails in the rail system for loss of material due to wear; monitor structural components of the bridge, trolley and hoists for deformation, cracking, and loss of material due to corrosion; and monitor structural connections/bolting for loose or missing bolts, nuts, pins or rivets and any other conditions indicative of loss of bolting integrity. (continued)	Prior to September 20, 2024.	A.1.23

No.	Program or Activity	Commitment	Implementation Schedule	Source
17 (cont)		b. Revise plant procedures to specify inspection frequency requirements will be in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. c. Revise plant procedures to require that significant loss of material due to wear of rails in the rail system and any sign of loss of bolting integrity will be evaluated in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. d. Revise plant procedures to specify that maintenance and repair activities will utilize the guidance provided in ASME B30.2 or other appropriate standard in the ASME B30 series.		
18	Internal Surfaces in Miscellaneous Piping and Ducting Components	Implement the new Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage fouling, cracking, loss of material, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of piping and components in environments other than open-cycle cooling water, closed treated water, and fire water. Program periodic surveillances or maintenance activities will be conducted when the surfaces are accessible for visual inspection.	Prior to September 20, 2024.	A.1.24
19	Metal Enclosed Bus Inspection	Implement the new Metal Enclosed Bus Inspection Program to provide for the inspection of the internal and external portions of metal enclosed bus to identify age-related degradation of the bus and bus connections, the bus enclosure assemblies, the bus insulation and the bus insulators.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.26

No.	Program or Activity	Commitment	Implementation Schedule	Source
20	Neutron-Absorbing Material Monitoring	Enhance Neutron-Absorbing Material Monitoring Program as follows: a. Prior to the period of extended operation, revise Neutron-Absorbing Material Monitoring Program procedures to establish an inspection frequency, justified with plant-specific operating experience, of at least once every ten years, based on the condition of the neutron-absorbing material. b. Revise Neutron-Absorbing Material Monitoring Program procedures to perform trending of coupon testing results to determine the rate of degradation. Ensure the predicted boron-10 areal density will be sufficient to maintain the subcritical conditions required by technical specifications until the next coupon test.	Prior to September 20, 2024.	A.1.27
21	Non-EQ Cable Connections	Implement the new Non-EQ Cable Connections Program, a 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.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.28

No.	Program or Activity	Commitment	Implementation Schedule	Source
22	Non-EQ Inaccessible Power Cables (400 V to 13.8 kV)	Implement the new Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program, a condition monitoring program that will manage the aging effect of reduced insulation resistance on inaccessible power (400 V to 13.8 kV) cables that have a license renewal intended function. The program calls for inaccessible or underground (e.g., in conduit, duct bank, or direct buried) power (greater than or equal to 400 volts) cables exposed to significant moisture, to be tested at least once every six years to provide an indication of the condition of the conductor insulation, with the first tests occurring before the period of extended operation. The program will include periodic inspections for water accumulation in manholes within the scope of this program.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.29

No.	Program or Activity	Commitment	Implementation Schedule	Source
23	Non-EQ Instrumentation Circuits Test Review	Implement the new Non-EQ Instrumentation Circuits Test Review Program, a performance monitoring program that will manage the aging effects of applicable cables in the following systems or sub-systems. • Neutron monitoring -Intermediate range channels (IRM) -Average power range monitors (includes local power range monitors [LPRM] detector strings) • Process radiation monitoring -Control center emergency air inlet radiation monitors -Fuel pool ventilation exhaust radiation monitors -Main steam line radiation monitors The Non-EQ Instrumentation Circuits Test Review Program calls for the review of calibration results or findings of surveillance tests on electrical cables and connections used in circuits with sensitive, high-voltage, low-level current signals, such as radiation monitoring and nuclear instrumentation, to provide an indication of the existence of aging effects based on acceptance criteria related to instrumentation circuit performance. The review of calibration results or findings of surveillance tests is performed at least once every ten years. In cases where cables are not included as part of calibration or surveillance program testing circuit, a proven cable test (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable system insulation condition as justified in the application) is performed. The test frequency is based on engineering evaluation and is at least once every ten years.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.30

No.	Program or Activity	Commitment	Implementation Schedule	Source
24	Non-EQ Insulated Cables and Connections	Implement the new Non-EQ Insulated Cables and Connections Program, a condition monitoring program that provides reasonable assurance the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. The program consists of accessible insulated electrical cables and connections installed in adverse localized environments to be visually inspected at least once every ten years.	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	A.1.31
25	Oil Analysis	Enhance Oil Analysis Program as follows: a. Revise Oil Analysis Program procedures to identify components within the scope of the program. b. Revise Oil Analysis Program procedures to provide a formalized analysis technique for particulate counting. c. Revise Oil Analysis Program procedures to include the sampling and testing requirements of equipment manufacturers or industry standards.	Prior to September 20, 2024.	A.1.32

No.	Program or Activity	Commitment	Implementation Schedule	Source
26	One-Time Inspection	Implement the new One-Time Inspection Program that will consist of a one-time inspection of selected components to accomplish the following: • Verify the effectiveness of an aging management program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The aging effects evaluated are loss of material, cracking, and fouling. • Confirm the insignificance of an aging effect for situations in which additional confirmation is appropriate using inspections that verify degradation is not occurring. • Trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.	Inspections will be performed within the ten years prior to March 20, 2025.	A.1.33
27	One-Time Inspection – Small-Bore Piping	Implement the new One-Time Inspection – Small-Bore Piping Program that will augment ASME Code, Section XI (2001 Edition with 2003 Addenda) requirements and be applicable to small-bore ASME Code Class 1 piping and components with a nominal pipe size diameter less than four inches (NPS 4) and greater than or equal to one inch (NPS 1) in systems that have not experienced cracking of ASME Code Class 1 small-bore piping.	The inspection will be performed within the six-year period prior to March 20, 2025.	A.1.34

No.	Program or Activity	Commitment	Implementation Schedule	Source
28	Periodic Surveillance and Preventive Maintenance	Enhance Periodic Surveillance and Preventive Maintenance Program as follows: a. Revise the Periodic Surveillance and Preventive Maintenance Program procedures as necessary to incorporate the identified activities in LRA Section A.1.35. b. Revise the Periodic Surveillance and Preventive Maintenance Program procedures to state that acceptance criterion is no indication of relevant degradation and to incorporate the following: • Examples of acceptance criteria for metallic components -No excessive corrosion (loss of material) -No leakage from or onto internal surfaces (loss of material) -No excessive wear (loss of material) • Examples of acceptance criteria for elastomeric components -Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color.	Prior to September 20, 2024.	A.1.35

No.	Program or Activity	Commitment	Implementation Schedule	Source
29	Protective Coating Monitoring and Maintenance	Enhance Protective Coating Monitoring and Maintenance Program as follows: a. Revise plant procedures to include in the program Service Level I coating applied to steel and concrete surfaces of the steel containment vessel (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors). b. Revise plant procedures to include information and instructions for monitoring Service Level I coating systems to be used for the inspection of coatings in accordance with guidelines identified in ASTM D5163-08. c. Revise plant procedures to specify the parameters monitored or inspected in accordance with subparagraph 10.2 of ASTM D5163-08. d. Revise plant procedures to establish the inspection frequency in accordance with paragraph 6 of ASTM D5163-08. e. Revise plant procedures to develop an inspection plan and specify inspection methods to be used as identified in accordance with subparagraph 10.1 of ASTM D5163-08. f. Revise plant procedures to specify that the nuclear coating specialist qualification recommendations and duties be as defined in ASTM D7108. As a minimum, qualification of inspection personnel (protective coating surveillance personnel) who perform these inspections shall be as specified in ASTM D4537. (continued)	Prior to September 20, 2024.	A.1.36

No.	Program or Activity	Commitment	Implementation Schedule	Source
29 (cont)		g. Revise plant procedures to specify a protective coatings program owner (inspection coordinator and inspection results evaluator) or equivalent to nuclear coating specialist defined in ASTM D5163-08, is responsible for the overall plant coatings program and has general duties and responsibilities similar to those defined for a nuclear coating specialist in Section 5 of ASTM D7108-05. h. Revise plant procedures to specify that detection of aging effects will include visual inspections of coatings near sumps or screens associated with the emergency core cooling system (ECCS). i. Revise plant procedures to specify instruments and equipment needed for inspection in accordance with subparagraph 10.5 of ASTM D5163-08. j. Revise plant procedures to specify that upon the completion of a planned refuel outage, a coatings outage summary report will be prepared of the coating work performed in Service Level I areas during the outage. The summary report prioritizes repair areas as areas that must be repaired during the same outage or postponed to future outages, keeping the coatings under surveillance during the interim period. k. Revise plant procedures to specify that the last two performance monitoring reports pertaining to the coating systems will be reviewed prior to the inspection or monitoring process. l. Revise plant procedures to describe the characterization, documentation, and testing of defective or deficient coating surface in accordance with subparagraphs 10.2.1 through 10.2.6, 10.3, and 10.4 of ASTM D5163-08. (continued)		

No.	Program or Activity	Commitment	Implementation Schedule	Source
29 (cont)		m. Revise plant procedures to specify that the coatings outage summary report will be evaluated and approved by the protective coatings program owner.		
30	Reactor Head Closure Studs	Enhance Reactor Head Closure Studs Program as follows:. a. Revise Reactor Head Closure Studs Program procedures to ensure that replacement studs are fabricated from bolting material with actual measured yield strength less than 150 kilo-pounds per square inch. b. Revise Reactor Head Closure Studs Program procedures to include a statement that excludes the use of molybdenum disulfide (MoS_2) on the reactor vessel closure studs and also refers to recommendations in Reg. Guide 1.65, Rev. 1.	Prior to September 20, 2024.	A.1.37
31	Reactor Vessel Surveillance	Enhance Reactor Vessel Surveillance Program as follows: a. Revise Reactor Vessel Surveillance Program procedures to ensure that new fluence projections through the period of extended operation and the latest vessel beltline adjusted reference temperature (ART) tables are provided to the BWRVIP prior to the period of extended operation.	Prior to September 20, 2024.	A.1.38
32	Selective Leaching	Implement the new Selective Leaching Program that will demonstrate the absence of selective leaching in a selected sample of components (i.e., 20 percent of the population with maximum of 25 components) fabricated from gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc or greater than 8 percent aluminum exposed to raw water, treated water, waste water, or soil.	Inspection will be performed within five years prior to March 20, 2025.	A.1.40

No.	Program or Activity	Commitment	Implementation Schedule	Source
33	Service Water Integrity	Enhance Service Water Integrity Program as follows: a. Revise Service Water Integrity Program procedures to include inspection to determine if loss of material due to erosion is occurring in the system. b. Revise Service Water Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.	Prior to September 20, 2024.	A.1.41
34	Structures Monitoring	Enhance Structures Monitoring Program as follows: a. Revise plant procedures to add the following structures to the program. • Condensate storage tank and condensate return tank foundations and retaining barrier • CTG-11-1 fuel oil storage tank foundation • Independent spent fuel storage installation (ISFSI) rail transfer pad • Manholes, handholes and duct banks • Shore barrier • Transformer and switchyard support structures and foundations b. Revise plant procedures to specify that the following in-scope structures are included in the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program (Section A.1.39): • General service water pump house • Residual heat removal complex • Shore barrier (continued)	Prior to September 20, 2024.	A.1.42

No.	Program or Activity	Commitment	Implementation Schedule	Source
34 (cont)		c. Revise plant procedures to ensure that masonry walls located in in-scope structures are in the scope of the Masonry Wall Program (Section A.1.25): d. Revise plant procedures to include a list of structural components and commodities within the scope of license renewal to be monitored in the program. e. Revise plant procedures to include periodic sampling and chemical analysis of ground water f. Revise plant procedures to include the following preventive actions: • Preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize the proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. • Preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." g. Revise plant procedures to include the following parameters to be monitored or inspected: • For concrete structures, base inspections on quantitative requirements of industry codes (i.e., ACI 349.3R), standards and guidelines (i.e., ASCE 11) and consideration of industry and plant-specific operating experience. • For concrete structures and components, include loss of material, loss of bond, increase in porosity and permeability, loss of strength, and reduction in concrete anchor capacity due to local concrete degradation. (continued)		

No.	Program or Activity	Commitment	Implementation Schedule	Source
34 (cont)		• For chemical analysis of ground water, monitor pH, chlorides, and sulfates. • Monitor gaps between the structural steel supports and masonry walls that could potentially affect wall qualification. h. Revise plant procedures to include the following components to be monitored for the associated parameters: • Structural bolting and anchors/fasteners (nuts and bolts) for loss of material, loose or missing nuts and/or bolts, and cracking of concrete around the anchor bolts. • Elastomeric vibration isolators and structural sealants for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening). i. Revise plant procedures to provide technical guidance for torque value requirements for specified bolting material subject to plant operating environments. j. Revise plant procedures to include the following for detection of aging effects: • Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R. • Visual inspection of elastomeric material should be supplemented by feel or touch to detect hardening if performance of the intended function of the elastomeric material is suspect. Include instructions to augment the visual examination of elastomeric material with physical manipulation of at least ten percent of available surface area. (continued)		

No.	Program or Activity	Commitment	Implementation Schedule	Source
34 (cont)		• Structures will be inspected at least once every five years. • Submerged structures will be inspected at least once every five years. • If normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring. • Sampling and chemical analysis of ground water at least once every five years. The Structures Monitoring Program owner will review the results and evaluate any anomalies and perform trending of the results. • Masonry walls will be inspected at least once every five years, with provisions for more frequent inspections in areas where significant aging effects (i.e., missing blocks, cracking, etc.) is observed to ensure there is no loss of intended function between inspections. • Inspection of water-control structures should be conducted under the direction of qualified personnel experienced in the investigation, design, construction, and operation of these types of facilities. • Inspections of water-control structures on an interval not to exceed five years. • Perform special inspections of water-control structures immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls. (continued)		

No.	Program or Activity	Commitment	Implementation Schedule	Source
34 (cont.)		k. Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.		
35	Water Chemistry Control – Closed Treated Water Systems	Enhance Water Chemistry Control – Closed Treated Water Systems Program as follows: a. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to include the following systems. • Process sampling system roughing cooler • CCHVAC chill water system b. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to provide chemical treatment including a corrosion inhibitor for the following systems in accordance with industry guidelines and vendor recommendations. • Process sampling system roughing cooler • CCHVAC chill water system c. Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to specify water chemistry parameters monitored and the acceptable range of values for these parameters in accordance with EPRI 1007820, industry guidance, or vendor recommendations. (continued)	Prior to September 20, 2024.	A.1.44

No.	Program or Activity	Commitment	Implementation Schedule	Source
35 (cont)		d. Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to inspect accessible components whenever a closed treated water system boundary is opened. Ensure that a representative sample of piping and components is inspected at a frequency of at least once every ten years. These inspections will be conducted in accordance with applicable ASME Code requirements, industry standards, or other plant-specific inspection guidance by qualified personnel using procedures that are capable of detecting corrosion, fouling, or cracking. If visual examination identifies adverse conditions, then additional examinations, including ultrasonic testing, are conducted. Components inspected will be those with the highest likelihood of corrosion, fouling, or cracking. A representative sample is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components. Perform treated water sampling and analysis of the closed treated water systems per industry standards and in no case greater than quarterly unless justified with an additional analysis.		

Appendix B

Aging Management Programs and Activities

Fermi 2
License Renewal Application

TABLE OF CONTENTS

B.0 INTRODUCTION

B.0.1 OVERVIEW

The aging management review results for the integrated plant assessment of Fermi 2 are presented in Sections 3.1 through 3.6 of this application. The programs credited in the integrated plant assessment for managing the effects of aging are described in this appendix.

Each aging management program described in this appendix has ten elements in accordance with the guidance in NUREG-1800 (Ref. B.2-1) Appendix A.1, "Aging Management Review – Generic," Table A.1-1, "Elements of an Aging Management Program for License Renewal." For aging management programs that are comparable to the programs described in Sections X and XI of NUREG-1801 (Ref. B.2-2), *Generic Aging Lessons Learned (GALL) Report*, the ten elements have been compared to the elements of the NUREG-1801 program and relevant ISGs (see Section 2.1.3). For the plant-specific program that does not correlate with NUREG-1801, the ten elements are addressed in the program description.

B.0.2 FORMAT OF PRESENTATION

For those aging management programs that are comparable to the programs described in Sections X and XI of NUREG-1801, the program discussion is presented in the following format.

- **Program Description**: abstract of the overall program as it will exist when fully implemented.
- **NUREG-1801 Consistency**: summary of the degree of consistency between the Fermi 2 program and the corresponding NUREG-1801 program, when applicable.
- **Exceptions to NUREG-1801**: exceptions to the NUREG-1801 program, including a justification for the exceptions, when applicable.
- **Enhancements**: future program enhancements with a proposed schedule for their completion, when applicable.
- **Operating Experience**: discussion of operating experience information specific to the program.
- **Conclusion**: statement of reasonable assurance that the program is effective, or will be effective, once implemented with necessary enhancements.

For the plant-specific program, a complete discussion of the ten elements of NUREG-1800 Table A.1-1 is provided.

B.0.3 CORRECTIVE ACTIONS, CONFIRMATION PROCESS AND ADMINISTRATIVE CONTROLS

Three elements common to all aging management programs are corrective actions, confirmation process and administrative controls. Discussion of these elements is presented below. Corrective actions have program-specific details which are included in the descriptions of the individual programs in this appendix, but further discussion of the confirmation process and administrative controls is not necessary and is not included in the descriptions of the individual programs.

Corrective Actions

Conditions adverse to quality—such as failures, malfunctions, deviations, defective material and equipment, and nonconformances—are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the condition is determined and that corrective action is taken to preclude recurrence. In addition, the identification and cause of the significant condition adverse to quality and the corrective action implemented are documented and reported to appropriate levels of management. The corrective action controls of the Fermi 2 Quality Assurance Program (10 CFR Part 50, Appendix B) are applicable to all aging management programs and activities required during the period of extended operation.

Confirmation Process

Corrective actions for systems, structures and components are accomplished per the existing Fermi 2 Corrective Action Program and Fermi 2 procedures. The site Corrective Action Program and procedure control program apply to license renewal aging management activities for both safety-related and nonsafety-related structures and components.

The confirmation process is part of the Corrective Action Program and includes the following:

- Reviews to assure that proposed actions are adequate for conditions adverse to quality.
- Tracking and reporting of open corrective actions.
- Review of corrective action effectiveness for significant conditions adverse to quality.

If the confirmation process leads to a corrective action requiring inspection or testing, the corrective action will be documented in accordance with the Corrective Action Program. The Corrective Action Program constitutes the confirmation process for Fermi 2 aging management programs and activities. The Fermi 2 confirmation process is consistent with NUREG-1801.

Administrative Controls

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The Fermi 2 QA Program applies to safety-related structures and components. The phrase "Administrative Controls" refers to the adherence to the policies, directives, and procedures and includes the formal review and approval process that procedures and manuals undergo as they are issued and subsequently revised. The Fermi 2 QA Program aspects related to procedure controls and administrative controls (document control requirements for procedures and manuals) and retention of records apply to Fermi aging management activities associated with license renewal for both safety-related and nonsafety-related structures, systems, and components. The Fermi 2 administrative controls are consistent with NUREG-1801.

B.0.4 OPERATING EXPERIENCE

Operating experience for the programs and activities credited with managing the effects of aging was reviewed. The operating experience review included a review of corrective actions resulting in program enhancements. For inspection programs, reports of recent inspections, examinations, or tests were reviewed to determine if aging effects have been identified on applicable components. For monitoring programs, reports of sample results were reviewed to determine if parameters are being maintained as required by the program. Also, program owners contributed evidence of program success or weakness and identified applicable self-assessments, QA audits, peer evaluations, and NRC reviews.

Operating experience is a crucial element of an effective aging management program (AMP). It provides the basis to support other elements of the AMP and, as a continuous feedback mechanism, drives changes to these elements to ensure the overall effectiveness of the AMP. The systematic review of plant-specific and industry operating experience concerning aging management and age-related degradation ensures that the license renewal AMPs will be effective in managing the aging effects for which they are credited.

Operating experience from plant-specific and industry sources is systematically reviewed on an ongoing basis in accordance with the quality assurance program, which meets the requirements of 10 CFR Part 50, Appendix B, and the operating experience program, which meets the requirements of NUREG-0737, *Clarification of TMI Action Plan Requirements*, Item I.C.5, "Procedures for Feedback of Operating Experience to Plant Staff."

Revisions to NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, and other NRC guidance documents on aging management are considered sources of operating experience.

The operating experience program interfaces with and relies on active participation in the Institute of Nuclear Power Operations' operating experience program, as endorsed by the NRC.

In accordance with procedure, incoming operating experience items are screened to identify items that may involve age-related degradation or impact to aging management programs (AMPs), including programs being developed. Items so identified are further evaluated, and AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed.

Plant-specific operating experience associated with aging management and age-related degradation is reported to the industry in accordance with guidelines established in the operating experience program.

DTE will make the following changes to the process for operating experience review (OER).

- Procedures will be revised to add an aging type code to Corrective Action Program documents that describe either plant conditions related to aging or industry operating experience related to aging.
- Procedures will be revised to provide for training of personnel responsible for submitting, screening, assigning, evaluating, or otherwise processing plant-specific and industry operating experience concerning age-related degradation and aging management, as well as for personnel responsible for implementing AMPs, based on the complexity of the job performance requirements and assigned responsibilities.
- Procedures will be revised to specify that evaluations of operating experience concerning age-related degradation will include consideration of the affected systems, structures or components, the environments, materials, aging effects, aging mechanisms and aging management programs.

DTE currently performs periodic self-assessments on many aging management programs. DTE will enhance the Fermi 2 self-assessment process to provide for periodic evaluation of the effectiveness of each aging management program described in the UFSAR supplement. For new aging management programs, the first evaluation will be performed within five years of implementing the program.

B.0.5 AGING MANAGEMENT PROGRAMS

Table B-1 lists the aging management programs described in this appendix. Programs are identified as either existing or new. The programs are either comparable to programs described in NUREG-1801 or are plant-specific. The correlation between NUREG-1801 programs and Fermi 2 programs is discussed in Section B.0.6.

Table B-1
Aging Management Programs

Program	Section	New or Existing
Aboveground Metallic Tanks	B.1.1	New
Bolting Integrity	B.1.2	Existing
Boraflex Monitoring	B.1.3	Existing
Buried and Underground Piping	B.1.4	New
BWR CRD Return Line Nozzle	B.1.5	Existing
BWR Feedwater Nozzle	B.1.6	Existing
BWR Penetrations	B.1.7	Existing
BWR Stress Corrosion Cracking	B.1.8	Existing
BWR Vessel ID Attachment Welds	B.1.9	Existing
BWR Vessel Internals	B.1.10	Existing
Compressed Air Monitoring	B.1.11	Existing
Containment Inservice Inspection — IWE	B.1.12	Existing
Containment Leak Rate	B.1.13	Existing
Diesel Fuel Monitoring	B.1.14	Existing
Environmental Qualification (EQ) of Electric Components	B.1.15	Existing
External Surfaces Monitoring	B.1.16	Existing
Fatigue Monitoring	B.1.17	Existing
Fire Protection	B.1.18	Existing
Fire Water System	B.1.19	Existing
Flow-Accelerated Corrosion	B.1.20	Existing
Inservice Inspection	B.1.21	Existing
Inservice Inspection–IWF	B.1.22	Existing
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	B.1.23	Existing
Internal Surfaces in Miscellaneous Piping and Ducting Components	B.1.24	New
Masonry Wall	B.1.25	Existing

Table B-1 (Continued)
Aging Management Programs

Program	Section	New or Existing
Metal Enclosed Bus Inspection	B.1.26	New
Neutron-Absorbing Material Monitoring	B.1.27	Existing
Non-EQ Cable Connections	B.1.28	New
Non-EQ Inaccessible Power Cable (400 V to 13.8 kV)	B.1.29	New
Non-EQ Instrumentation Circuits Test Review	B.1.30	New
Non-EQ Insulated Cables and Connections	B.1.31	New
Oil Analysis	B.1.32	Existing
One-Time Inspection	B.1.33	New
One-Time Inspection – Small-Bore Piping	B.1.34	New
Periodic Surveillance and Preventive Maintenance	B.1.35	Existing
Protective Coating Monitoring and Maintenance	B.1.36	Existing
Reactor Head Closure Studs	B.1.37	Existing
Reactor Vessel Surveillance	B.1.38	Existing
RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	B.1.39	Existing
Selective Leaching	B.1.40	New
Service Water Integrity	B.1.41	Existing
Structures Monitoring	B.1.42	Existing
Water Chemistry Control – BWR	B.1.43	Existing
Water Chemistry Control – Closed Treated Water Systems	B.1.44	Existing

B.0.6 CORRELATION WITH NUREG-1801 AGING MANAGEMENT PROGRAMS

The correlation between NUREG-1801 programs and Fermi 2 programs is shown below in Table B-2. For the Fermi 2 programs, links to appropriate sections of this appendix are provided. Table B-3 summarizes the consistency of Fermi 2 programs with NUREG-1801 programs.

Table B-2
Fermi 2 Aging Management Program Correlation with NUREG-1801 Programs

NUREG-1801 Number	NUREG-1801 Program	Fermi 2 Program
X.E1	Environmental Qualification (EQ) of Electric Components	Environmental Qualification (EQ) of Electric Components [B.1.15]
X.M1	Fatigue Monitoring	Fatigue Monitoring [B.1.17]
X.S1	Concrete Containment Tendon Prestress	Fermi 2 does not have pre-stressed tendons in the containment structure. This NUREG-1801 program does not apply.
XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Inservice Inspection [B.1.21]
XI.M2	Water Chemistry	Water Chemistry Control – BWR [B.1.43]
XI.M3	Reactor Head Closure Stud Bolting	Reactor Head Closure Studs [B.1.37]
XI.M4	BWR Vessel ID Attachment Welds	BWR Vessel ID Attachment Welds [B.1.9]
XI.M5	BWR Feedwater Nozzle	BWR Feedwater Nozzle [B.1.6]
XI.M6	BWR Control Rod Drive Return Line Nozzle	BWR CRD Return Line Nozzle [B.1.5]
XI.M7	BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking [B.1.8]
XI.M8	BWR Penetrations	BWR Penetrations [B.1.7]
XI.M9	BWR Vessel Internals	BWR Vessel Internals [B.1.10]

Table B-2 (Continued)
Fermi 2 Aging Management Program Correlation with NUREG-1801 Programs

NUREG-1801 Number	NUREG-1801 Program	Fermi 2 Program
XI.M10	Boric Acid Corrosion	Fermi 2 is a BWR. This NUREG-1801 program does not apply.
XI.M11B	Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs only)	Fermi 2 is a BWR. This NUREG-1801 program does not apply.
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	This NUREG-1801 program is not credited for aging management. RCS piping components do not meet the susceptibility criteria of XI.M12.
XI.M16A	PWR Vessel Internals	Fermi 2 is a BWR. This NUREG-1801 program does not apply.
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion [B.1.20]
XI.M18	Bolting Integrity	Bolting Integrity [B.1.2]
XI.M19	Steam Generators	Fermi 2 is a BWR. This NUREG-1801 program does not apply.
XI.M20	Open-Cycle Cooling Water System	Service Water Integrity [B.1.41]
XI.M21A	Closed Treated Water Systems	Water Chemistry Control – Closed Treated Water Systems [B.1.44]
XI.M22	Boraflex Monitoring	Boraflex Monitoring [B.1.3]
XI.M23	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems [B.1.23].
XI.M24	Compressed Air Monitoring	Compressed Air Monitoring [B.1.11]

Table B-2 (Continued)
Fermi 2 Aging Management Program Correlation with NUREG-1801 Programs

NUREG-1801 Number	NUREG-1801 Program	Fermi 2 Program
XI.M25	BWR Reactor Water Cleanup System	Not credited for aging management. Refer to relevant discussion in Table 3.3.1, Item 3.3.1-16.
XI.M26	Fire Protection	Fire Protection [B.1.18]
XI.M27	Fire Water System	Fire Water System [B.1.19]
XI.M29	Aboveground Metallic Tanks	Aboveground Metallic Tanks [B.1.1]
XI.M30	Fuel Oil Chemistry	Diesel Fuel Monitoring [B.1.14]
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Surveillance [B.1.38]
XI.M32	One-Time Inspection	One-Time Inspection [B.1.33]
XI.M33	Selective Leaching	Selective Leaching [B.1.40]
XI.M35	One-Time Inspection of ASME Code Class 1 Small-Bore Piping	One-Time Inspection – Small-Bore Piping [B.1.34]
XI.M36	External Surfaces Monitoring of Mechanical Components	External Surfaces Monitoring [B.1.16]
XI.M37	Flux Thimble Tube Inspection	Fermi 2 is a BWR. This NUREG-1801 program does not apply.
XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Internal Surfaces in Miscellaneous Piping and Ducting Components [B.1.24]
XI.M39	Lubricating Oil Analysis	Oil Analysis [B.1.32]
XI.M40	Monitoring of Neutron-Absorbing Materials Other than Boraflex	Neutron-Absorbing Material Monitoring [B.1.27]
XI.M41	Buried and Underground Piping and Tanks	Buried and Underground Piping [B.1.4]

Table B-2 (Continued)
Fermi 2 Aging Management Program Correlation with NUREG-1801 Programs

NUREG-1801 Number	NUREG-1801 Program	Fermi 2 Program
XI.E1	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Insulated Cables and Connections [B.1.31]
XI.E2	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Non-EQ Instrumentation Circuits Test Review [B.1.30]
XI.E3	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) [B.1.29]
XI.E4	Metal Enclosed Bus	Metal Enclosed Bus Inspection [B.1.26]
XI.E5	Fuse Holders	Not credited for aging management. Refer to relevant discussion in Table 3.6.1, Items 3.6.1-16 and 3.6.1-17.
XI.E6	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Cable Connections [B.1.28]
XI.S1	ASME Section XI, Subsection IWE	Containment Inservice Inspection — IWE [B.1.12]
XI.S2	ASME Section XI, Subsection IWL	Fermi 2 does not have a Class CC concrete containment that requires an IWL program. This NUREG-1801 program does not apply.
XI.S3	ASME Section XI, Subsection IWF	Inservice Inspection – IWF [B.1.22]

Table B-2 (Continued)
Fermi 2 Aging Management Program Correlation with NUREG-1801 Programs

NUREG-1801 Number	NUREG-1801 Program	Fermi 2 Program
XI.S4	10 CFR 50, Appendix J	Containment Leak Rate [B.1.13]
XI.S5	Masonry Walls	Masonry Wall [B.1.25]
XI.S6	Structures Monitoring	Structures Monitoring [B.1.42]
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants [B.1.39]
XI.S8	Protective Coating Monitoring and Maintenance	Protective Coating Monitoring and Maintenance [B.1.36]
Plant-Specific Programs		
NA	Plant-specific program	Periodic Surveillance and Preventive Maintenance [B.1.35]

Table B-3
Fermi 2 Program Consistency with NUREG-1801

Program Name	NUREG-1801 Comparison			Plant-Specific
	Consistent with NUREG-1801	Programs with Enhancement	Programs with Exception to NUREG-1801	
Aboveground Metallic Tanks	X			
Bolting Integrity		X	X	
Boraflex Monitoring	X	X		
Buried and Underground Piping	X			
BWR CRD Return Line Nozzle	X			
BWR Feedwater Nozzle	X			
BWR Penetrations	X			
BWR Stress Corrosion Cracking	X			
BWR Vessel ID Attachment Welds	X			
BWR Vessel Internals	X	X		
Compressed Air Monitoring		X	X	
Containment Inservice Inspection — IWE	X	X		
Containment Leak Rate	X			
Diesel Fuel Monitoring	X	X		
Environmental Qualification (EQ) of Electric Components	X			
External Surfaces Monitoring	X	X		
Fatigue Monitoring		X	X	

Table B-3 (Continued)
Fermi 2 Program Consistency with NUREG-1801

Program Name	NUREG-1801 Comparison			Plant-Specific
	Consistent with NUREG-1801	Programs with Enhancement	Programs with Exception to NUREG-1801	
Fire Protection	X	X		
Fire Water System	X	X		
Flow-Accelerated Corrosion	X	X		
Inservice Inspection	X			
Inservice Inspection – IWF	X	X		
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	X	X		
Internal Surfaces in Miscellaneous Piping and Ducting Components	X			
Masonry Wall	X	X		
Metal Enclosed Bus Inspection	X			
Neutron-Absorbing Material Monitoring	X	X		
Non-EQ Cable Connections	X			
Non-EQ Inaccessible Power Cables (400 V to 13.8 kV)	X			
Non-EQ Instrumentation Circuits Test Review	X			
Non-EQ Insulated Cables and Connections	X			
Oil Analysis	X	X		

Table B-3 (Continued)
Fermi 2 Program Consistency with NUREG-1801

Program Name	NUREG-1801 Comparison			Plant-Specific
	Consistent with NUREG-1801	Programs with Enhancement	Programs with Exception to NUREG-1801	
One-Time Inspection	X			
One-Time Inspection – Small-Bore Piping	X			
Periodic Surveillance and Preventive Maintenance				X
Protective Coating Monitoring and Maintenance	X	X		
Reactor Head Closure Studs		X	X	
Reactor Vessel Surveillance		X	X	
RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	X	X		
Selective Leaching	X			
Service Water Integrity	X	X		
Structures Monitoring	X	X		
Water Chemistry Control – BWR	X			
Water Chemistry Control – Closed Treated Water Systems	X	X		

B.1 AGING MANAGEMENT PROGRAMS AND ACTIVITIES

B.1.1 ABOVEGROUND METALLIC TANKS

Program Description

The Aboveground Metallic Tanks Program is a new program that will manage loss of material and cracking for outdoor tanks within the scope of license renewal that are sited on soil or concrete. Preventive measures to mitigate corrosion and cracking were applied during construction, such as using the appropriate materials, protective coatings, and elevation as specified in design and installation specifications. For the painted carbon steel combustion turbine generator (CTG) fuel oil tank, the program will monitor the external surface condition for indications and precursors of loss of material. For the insulated aluminum condensate storage tank (CST), the program will monitor the condition of a representative sample of the tank external surface for signs of loss of material and cracking using visual inspections and surface examinations. Exterior portions of the tanks will be inspected in accordance with Table 4a, "Tank Inspection Recommendations," identified in LR-ISG-2012-02. There are no indoor tanks included in this program.

CST internal inspections will be conducted in accordance with Table 4a, identified above. Internal inspections of the CTG fuel oil tank will be conducted in accordance with NUREG-1801, XI.M30.

This program will also manage the bottom surfaces of both in-scope aboveground metallic tanks, which are on concrete ring foundations and sand. The program will require ultrasonic testing (UT) of the tank bottoms to assess the thickness against the thickness specified in the design specification. The UT testing of the tank bottoms will be performed whenever the tanks are drained or at intervals not less than those recommended in Table 4a during the period of extended operation. In accordance with installation and design specifications, the tanks do not employ caulking or sealant at the concrete/tank interface.

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

NUREG-1801 Consistency

The Aboveground Metallic Tanks Program will be consistent with the program described in NUREG-1801, Section XI.M29, Aboveground Metallic Tanks, as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation."

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Aboveground Metallic Tanks Program is a new program. Industry operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

As discussed in element 10 to NUREG-1801, Section XI.M29, this program considers the technical information and industry operating experience provided in NRC Generic Letter (GL) 98-04; NRC Information Notice (IN) 89-79; IN 89-79, Supplement 1; IN 86-99; and IN 86-99, Supplement 1.

The review of operating experience at Fermi 2 concluded that no aging mechanisms not considered in NUREG-1801 have been identified.

Although the Aboveground Metallic Tanks Program is a new program, Fermi 2 has in place basic elements of the program, such as routine inspections performed to industry standards, deficiency identification processes, and corrective actions. The following examples provide objective evidence that when the Aboveground Metallic Tanks Program is established, it will be effective in ensuring that intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

- In April 2000, due to suspected fuel contamination, the CTG fuel oil storage tank was drained, cleaned, and inspected. Minor pitting was repaired and an epoxy liner was installed on the tank floor to protect the floor from further pitting. Measures were instituted to drain the tank and inspect its internals every 20 years.
- In August 2005, to address a requirement imposed by the State of Michigan, an external inspection of the CTG fuel oil storage tank was conducted. This inspection met the provisions of American Petroleum Institute API-653, "Tank Inspection, Repair, Alteration, and Reconstruction." Inspectors identified only minor deficiencies, which were entered into the Corrective Action Program and corrected. Fermi established measures to repeat the external inspection every five years. During the August 2010 inspection, no significant deficiencies were noted.
- Routine inspections of the condensate storage tank have identified deficiencies in flashing, insulation, screening, and painted surfaces. These deficiencies were entered into the Corrective Action Program and repairs were completed. This included replacing the tank roof insulation.

The visual inspection and UT thickness measurement methods used in this program to detect aging effects are proven industry techniques that have been effectively used at Fermi 2 in other programs. Accordingly, there is reasonable assurance that this new aging management program will be effective during the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Aboveground Metallic Tanks Program will be effective at identifying and managing aging effects of loss of material and cracking of in-scope tanks because it incorporates proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Aboveground Metallic Tanks Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.2 BOLTING INTEGRITY

Program Description

The Bolting Integrity Program manages loss of preload, cracking, and loss of material for accessible closure bolting for safety-related and nonsafety-related pressure-retaining components using preventive and inspection activities. This program does not include the reactor head closure studs or structural bolting. Preventive measures include material selection (e.g., use of materials with an actual yield strength of less than 150 kilo-pounds per square inch [ksi]), lubricant selection (e.g., restricting the use of molybdenum disulfide [MoS_2]), applying the appropriate preload (torque), and checking for uniformity of gasket compression where appropriate to preclude loss of preload, loss of material, and cracking. This program supplements the inspection activities required by ASME Section XI for ASME Class 1, 2, and 3 bolting. For ASME Class 1, 2, and 3 accessible bolting and non-ASME Code class accessible bolts, periodic system walkdowns and inspection (at least once per refueling cycle) ensure identification of indications of loss of preload (leakage), cracking, and loss of material before leakage becomes excessive. Identified leaking bolted connections will be monitored at an increased frequency in accordance with the corrective action process. Applicable industry standards and guidance documents are used to delineate the program, including NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants;* EPRI NP-5769, *Degradation and Failure of Bolting in Nuclear Power Plants;* and EPRI TR-104213, *Bolted Joint Maintenance and Applications Guide.*

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 exception.

Exceptions to NUREG-1801

The Bolting Integrity Program has the following exception.

Element Affected	Exception
4. Detection of Aging Effects	NUREG-1801 recommends periodic inspections of bolting at least once per refueling cycle. Buried fire water system bolting is inspected if excavated for maintenance or other activities.[1]

Exception Notes

1. The Bolting Integrity program manages only loss of preload for buried fire water system bolting. Preventive measures are taken before burial, such as verifying correct material, checking for uniformity of the gasket compression after assembly, using preventive coating, and applying an appropriate preload. These measures have proven effective in preventing loss of preload for buried fire water system bolting.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
2. Preventive Actions	Revise Bolting Integrity Program procedures to ensure consideration of actual yield strength when procuring high-strength bolting material. If procured, closure bolting with actual yield strength ≥ 150 ksi is monitored for cracking.
3. Parameters Monitored or Inspected	Revise Bolting Integrity Program procedures to state that accessible bolting for safety-related pressure retaining components is inspected for leakage, loss of material, cracking, and loss of preload/loss of prestress. Closure bolting with actual yield strength ≥ 150 ksi is monitored for cracking.
4. Detection of Aging Effects	Revise Bolting Integrity Program procedures to (1) implement applicable recommendations for pressure boundary bolting in NUREG-1339, EPRI NP-5769, and EPRI TR-104213; (2) state both ASME Code class accessible bolted connections and non-ASME Code class accessible bolted connections are inspected at least once per refueling cycle; and (3) include volumetric examination per ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, for closure bolting with actual yield strength ≥ 150 ksi regardless of code classification.
4. Detection of Aging Effects	Revise Bolting Integrity Program procedures to inspect RHRSW, EESW, and EDGSW systems' pump and valve bolting submerged in the RHRSW reservoir at least once every refueling outage.
7. Corrective Actions	Revise Bolting Integrity Program procedures to include the additional guidance and recommendations of EPRI NP-5769 for replacement of ASME pressure-retaining bolts and the guidance provided in EPRI TR-104213 for the replacement of other pressure-retaining bolts.
9. Administrative Controls	Revise Bolting Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Operating Experience

The following examples of operating experience provide objective evidence that the Bolting Integrity Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- During the 2003 performance of Division 1 residual heat removal (RHR) reservoir dive inspection, divers found the flange bolts corroded on all Division 1 RHR complex service water pumps. Submerged bolts on all RHR service water (RHRSW) pumps were replaced and other bolts on pumps in the reservoir were replaced as needed. A preventive maintenance activity for pump refurbishment or replacement was established, with new material selected for replacement bolts. In addition, the chemical addition process was changed to reduce corrosion.
- During ISI NDE inspections, loose pressure seal bonnet bolting was discovered on valve E1150-F009. Sample expansion in accordance with IWB-2430 required inspection of 13 additional valve bolting sets, which is the number of similar items that would be covered during one inspection period. A second valve (B2100-F011B) was found with loose pressure seal bonnet bolting. The issue was entered into the Corrective Action Program and the leaking bonnets were repaired. The process related to post-maintenance testing was revised to ensure torque requirements are met when valves are at pressure. A follow-up effectiveness review conducted in 2007 found that the condition had not recurred.
- NRC Information Notice 2008-05, "Fires Involving Emergency Diesel Generator Exhaust Manifolds," was evaluated for applicability through the corrective action process. As a result of this review, maintenance procedures were revised to require torquing engine top cover bolts per vendor specification.

As discussed in element 10 to NUREG-1801, Section XI.M18, this program considers the technical information and industry operating experience provided in NRC IE Bulletin 82-02 and NRC Generic Letter 91-17.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Bolting Integrity Program will remain effective. The continued application of these proven methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Bolting Integrity Program has been effective at managing the aging effects of loss of preload, cracking, and loss of material. The Bolting Integrity Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.3 BORAFLEX MONITORING

Program Description

The Boraflex Monitoring Program manages the aging effect of reduction in neutron-absorbing capacity (change in material properties) in the Boraflex material affixed to spent fuel racks. A monitoring program for the Boraflex panels in the spent fuel storage racks is implemented to assure that no unexpected degradation of the Boraflex material compromises the criticality analysis in support of the design of spent fuel storage racks. The program uses the RACKLIFE computer predictive code to calculate the gamma dose absorbed by and the amount of boron carbide loss from the Boraflex panels. The program includes (a) quarterly sampling and analysis for silica levels in the spent fuel pool water and trending the results by using the RACKLIFE code, (b) performing periodic physical measurements and neutron attenuation testing of surveillance coupons, and (c) areal B-10 density measurement testing of the spent fuel storage racks, such as BADGER testing, at a frequency of at least once every five years. This program, implemented in response to NRC GL 96-04, assures that the required five percent sub-criticality margin is maintained.

NUREG-1801 Consistency

The Boraflex Monitoring Program, with enhancement, is consistent with the program described in NUREG-1801, Section XI.M22, Boraflex Monitoring.

Exceptions to NUREG-1801

None

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Element Affected	Enhancement
3. Parameters Monitored or Inspected 4. Detection of Aging Effects 5. Monitoring and Trending	Revise Boraflex Monitoring Program procedures to include areal B-10 density measurement testing of the spent fuel storage racks, such as BADGER testing, at a frequency of at least once every five years.

Operating Experience

The following examples demonstrate how the Boraflex Monitoring Program will be effective in managing the effects of aging during the period of extended operation.

- In response to NRC IN 87-43, National Nuclear Corporation completed a "blackness test" on March 28, 1992. Approximately one-third of the Boraflex panels in the Fermi 2 spent fuel racks had developed cracks and small gaps. Slow scan test measurements provided data as to the axial distribution of gaps and the size of gaps. Both the size measurements and observed axial distribution are consistent with similar measurements in other racks of the same design at other plants. Analyses were performed to show that adequate subcritical margin was maintained.

- NRC Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks," requested evaluation of the condition of the Boraflex in the spent fuel racks. The response addressed the results of testing and committed to using RACKLIFE to model the Fermi 2 fuel racks and monitoring rack exposure and pool silica to identify degradation of Boraflex.

- In 1998, Boraflex coupons were tested at Pennsylvania State University in accordance with Fermi 2 procedures, Technical Specifications, and UFSAR Section 9.1.2.4. This testing showed that the coupons that acquired the largest dose had more shrinkage than allowed by the acceptance criteria. The criticality analysis was updated to account for this increased shrinkage, and the UFSAR analysis on shrinkage was revised.

- In 2009, the silica level in the spent fuel pool was found at a level above that observed in previous cycles. Preparations were initiated to perform BADGER testing, which was performed in October 2013.

- In 2011, coupon testing was performed on four Boraflex surveillance coupons at Pennsylvania State University. All applicable test criteria for the coupons were satisfied by the coupons.

- In 2012, NRC IN 2012-13 was reviewed regarding surveillance programs and corrective actions at Turkey Point and Peach Bottom with regards to Boraflex degradation monitoring. Based on the review, revisions were made to inputs so that RACKLIFE will provide more conservative calculations.

- In October 2013, BADGER testing was performed on sixty Boraflex panels in the spent fuel racks. There were three panels that fell below the limit. A criticality sensitivity analysis showed margin in these panels' results to what is needed to maintain the required five percent sub-criticality margin. Actions were taken to preclude placing fuel in the cells adjacent to the three panels. A corrective action document was written to evaluate impacts of the BADGER testing results on the Boraflex Monitoring Program.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Boraflex Monitoring Program will remain effective. The application of proven monitoring methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Boraflex Monitoring Program has been effective at managing the aging effect of reduction in neutron-absorbing capacity in the Boraflex material affixed to spent fuel racks. The Boraflex Monitoring Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.4 BURIED AND UNDERGROUND PIPING

Program Description

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 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.

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 4a of NUREG-1801, Section XI.M41 is taken based on a lack of soil corrosivity.

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

NUREG-1801 Consistency

The Buried and Underground Piping Program will be consistent with the program described in NUREG-1801, Section XI.M41, Buried and Underground Piping and Tanks, as modified by LR-ISG-2011-03, *Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program XI.M41, "Buried and Underground Piping and Tanks."*

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following discussion provides objective evidence that the Buried and Underground Piping Program, when fully established, will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

The Buried and Underground Piping Program is a new program being implemented at Fermi 2. Implementation began in response to industry initiatives on ground water protection and buried piping integrity. The program implementation has been in accordance with NEI 09-14.

An inspection plan based on risk ranking was developed, and assessments of pipe external and internal conditions were performed. In addition to external and internal condition assessment, soil samples were tested for corrosivity, and the cathodic protection system was assessed for effectiveness. The following are examples of the inspections, corrective measures and assessments that were performed.

- In 2009, a section of buried fire protection piping was removed for a modification. An opportunistic inspection was conducted. The pipe section was inspected externally and internally. Visual inspection of the asphalt coating found it in excellent condition. The coating thickness was ½ inch or greater, and there was no fill rock embedded in the coating. The coating tightly adhered to the pipe, and upon its removal, no sign of external surface corrosion was observed. Additionally, coating at the flange joint was also in good condition. There was minimal corrosion on the flange face.

- In 2010, a guided wave test was conducted for several buried condensate lines containing tritiated water. No degradation was found in operating lines. An indication was found in a segment of a spare condensate line. Testing could not distinguish if it was internal or external degradation. The spare line was cut, drained and capped, thus eliminating a potential leak path for tritiated water.

- During a plant modification in 2011, a soil sample and potential measurements were taken in an area containing fire protection, circulating water, and safety-related service water piping. The soil samples and potential measurements were used to estimate corrosion rates and used with other operating experience to adjust the inspection plan.

- Direct visual examinations were conducted in 2012 on condensate, radwaste and fuel oil system piping. Soil samples and potential measurements were also taken. Some protective coating was found in poor condition; however, testing showed adequate cathodic protection. A guided wave monitoring system was installed at one location to monitor for future indications of degradation.

- In 2012, a visual inspection of a buried general service water pipe was conducted. Degraded protective coating was found. The protective coating was partially removed to facilitate inspection of the external surface of the pipe. In general, the external surface was in good condition, and the cathodic protection appears effective in this area. Ultrasonic thickness measurements were taken that demonstrated acceptability of areas with localized pitting.

- In 2013, two examinations were performed on buried piping in the combustion turbine generator fuel oil and the residual heat removal service water systems. Visual and volumetric examinations were performed. A total of three soil samples were also collected from the excavations to assess corrosivity of the soils. Negligible external corrosion rates were estimated based on field data and laboratory analysis for the samples collected in the combustion turbine generator excavation. Testing of the exposed piping segment in the residual heat removal service water excavation showed adequate cathodic protection to yield an acceptable corrosion rate. Visual and volumetric testing of the exposed piping was conducted, and the condition was found acceptable for continued service. A guided wave monitoring system was installed at one location to monitor for future indications of degradation.

- In 2013, the NRC conducted an inspection of the program being implemented in response to the NEI buried piping integrity initiative and identified no findings.

The cathodic protection system is inspected and tested annually in accordance with National Association of Corrosion Engineers recommendations. Improvements are planned to increase system coverage through installation of additional anodes and rectifiers.

The preventive measures and inspection methods implemented under the Buried and Underground Piping Program will be effective in mitigating and detecting aging effects. Review of operating experience at Fermi 2 identified no aging mechanisms not already considered in Section XI.M41 of NUREG-1801 and LR-ISG-2011-03. Therefore, there is reasonable assurance that the Buried and Underground Piping Program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Buried and Underground Piping Program will be effective in identifying and managing aging effects on the external surfaces of buried and underground piping components because it incorporates proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. Implementation of the Buried and Underground Piping Program will provide reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.5 BWR CRD RETURN LINE NOZZLE

Program Description

The BWR Control Rod Drive (CRD) Return Line Nozzle Program manages cracking of the CRD return line nozzle using preventive, mitigative, and inservice inspection activities, in accordance with Fermi 2 commitments to implement the recommendations in NUREG-0619, *BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking*, and ASME Code Section XI, Subsection IWB, Table IWB 2500-1. Examinations that can detect the presence of cracking are performed to assure detection of cracks before the loss of intended function of the CRD return line nozzle. Cracking found during inservice inspection is evaluated in accordance with ASME Code Section XI requirements. The CRD return line nozzle was capped during construction prior to plant operation.

NUREG-1801 Consistency

The BWR CRD Return Line Nozzle Program is consistent with the program described in NUREG-1801, Section XI.M6, BWR Control Rod Drive Return Line Nozzle.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following examples of operating experience provide objective evidence that the BWR CRD Return Line Nozzle Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- Routine inspection of the BWR CRD Return Line Nozzle is required per the ISI-NDE Program. This nozzle was inspected in 2003 during RF09 with satisfactory results. It was inspected again in 2012 during RF15 also with satisfactory results. The inspection consists of a UT of the nozzle-to-shell weld and the nozzle-to-cap weld (external) and a visual inspection of the inner radius (internal).
- In 2013, during the reactor vessel internals management self-assessment, a review was performed to ensure that procedures and inspections performed in 2010 and 2012 met the Boiling Water Reactor Vessel and Internals Project (BWRVIP) guidelines established in BWRVIP-03. The self-assessment determined that the 2012 inner radius visual inspection did not meet ASME code requirements. A video file documents VT-1 quality examination of the nozzle up to the location of the pads. However, the camera angle and lack of the use of

zoom does not support VT-1 requirements for the area beyond the location of the pads, which is approximately 4 inches of the examination area. Therefore, the inspection was only 70 percent compliant versus the 90 percent criteria to achieve a fully credited examination. To meet BWRVIP and ASME Code provisions, the CRD return line nozzle inner radius visual inspection has been rescheduled for RF16. The governing inspection procedure has been revised to provide better guidance for this inspection.

The results of past inspections indicate that the BWR CRD Return Line Nozzle Program has been effective. The continued application of these proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The BWR CRD Return Line Nozzle Program has been effective at managing the aging effect of cracking. The BWR CRD Return Line Nozzle Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.6 BWR FEEDWATER NOZZLE

Program Description

The BWR Feedwater Nozzle Program manages cracking of the BWR feedwater nozzles using inspection activities to monitor the effects of cracking due to cyclic loading.

This program augments the examinations specified in the ASME Code, Section XI, with the recommendation and schedule of General Electric (GE) NE-523-A71-0594-A, Revision 1, *Alternate BWR Feedwater Nozzle Inspection Requirements,* and NUREG-0619 to perform periodic testing of critical regions of the BWR feedwater nozzles. The feedwater nozzles were never clad and include the improved sparger design. Cracking is evaluated and dispositioned in accordance with the ASME Code.

NUREG-1801 Consistency

The BWR Feedwater Nozzle Program is consistent with the program described in NUREG-1801, Section XI.M5, BWR Feedwater Nozzle.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following examples of operating experience provide objective evidence that the BWR Feedwater Nozzle Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- The feedwater nozzles at Fermi 2 were never clad. During construction, the safe ends were replaced to allow installation of triple sleeve spargers.
- A manual ultrasonic examination of the nozzle inner radius and inner bore was performed each outage on three of the six nozzles. Beginning in 2000, Fermi 2 used a qualified automated ultrasonic technique to assess the integrity of the nozzle inner radius/bore in accordance with the alternative BWR feedwater nozzle inspection provisions detailed in GE-NE-523-A71-0594-A. The application of this alternative exam eliminated the need for liquid penetrant (PT) of the nozzle area. However, visual inspection of the nozzle is still scheduled every four cycles.

- In 2003, during RF09, inspections were performed on Spargers C, E, and F as well as the end brackets, with no recordable indications identified.
- In 2004, during RF10, inspections were performed on Spargers A, B and D as well as the end brackets, with no recordable indications identified.
- In 2007, during RF12, inspections were performed on all of the feedwater spargers including the end brackets, with no recordable indications identified. End brackets and end bracket pins were specifically inspected for wear based on operating experience from other plants. No wear was identified at any location. These inspections met the recommendation contained in Service Information Letter (SIL) 658, Revision 0.
- In 2010, during RF14, inspections were performed on Spargers C, E, and F as well as the end brackets, with no recordable indications identified. End brackets and end bracket pins were inspected for wear. No wear was identified at any location. These inspections met the recommendation contained in SIL 658, Revision 0.
- In 2012, inspections were performed on Spargers A, B, and D as well as the end brackets, with no recordable indications identified. End brackets and end bracket pins were inspected for wear. No wear was identified at any location, but pin movement was noted on a sparger end bracket. These inspections met the recommendation contained in SIL 658, Revision 0.
- In 2012, the unclad areas of the feedwater nozzles were inspected. The inspection identified no changes from the conditions observed in previous inspections.

No indications of cracking have been discovered on the feedwater nozzles.

The continued application of proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The BWR Feedwater Nozzle Program has been effective at managing the aging effect of cracking of carbon steel feedwater nozzles. The BWR Feedwater Nozzle Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.7 BWR PENETRATIONS

Program Description

The BWR Penetrations Program manages cracking due to cyclic loading or stress corrosion cracking (SCC) and intergranular SCC (IGSCC) of BWR instrument penetrations, CRD housing and incore housing (ICH) penetrations, and standby liquid control (SLC) nozzles/core ΔP nozzles.

Leakage inspections (VT-2) and ultrasonic inspections are scheduled and performed, flaws are evaluated, scope is expanded as required, and acceptance criteria are provided in accordance with the guidelines of the ASME Code Section XI and NRC-approved BWRVIP-49-A, BWRVIP-47-A, and BWRVIP-27-A.

NUREG-1801 Consistency

The BWR Penetrations Program is consistent with the program described in NUREG-1801, Section XI.M8, BWR Penetrations.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following examples of operating experience provide objective evidence that the BWR Penetrations Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation:

- Instrument Penetrations

  Fermi 2 has performed VT-2 inspections as part of the ISI Program. There have been no pressure boundary failures identified. Inspections of vessel instrument penetrations and nozzles beginning with RF09 (2003) included direct inspection of the reactor vessel exterior in the annulus area between the mirror insulation and reactor vessel, as well as inside the reactor vessel skirt for evidence of leakage. No leakage has been detected since beginning the inspections in 2003.

- Control Rod Drive Housings

  Prior to BWRVIP-47 implementation, no direct inspection or repair history was available for these components. During RF04 while performing jet pump hold down beam replacement, VT-3 inspections were performed on accessible areas of peripheral control rod drive housings and stub tubes.

  All baseline inspections specified in BWRVIP-47 were completed by the end of RF14. No indications of cracking were identified. However, a manufacturing discontinuity was identified on the CRGT-2 weld in cell 06-35. This condition was evaluated and accepted.

  After each refueling outage, Fermi 2 performs a system leak test in accordance with ASME Section XI with visual inspection (VT-2) of the vessel exterior. Thus, leakage caused by through-wall cracking would be detected during this test prior to startup. No through-wall leakage has been detected during inspections performed since 2003.

- In-Core Housing

  After each refueling outage, Fermi 2 performs a system leak test in accordance with ASME Section XI with visual inspection (VT-2) of the vessel exterior. Thus, leakage caused by through-wall cracking would be detected during this test prior to startup. No through-wall leakage has been detected during inspections performed since 2003.

- Core Plate ΔP and Standby Liquid Control Lines

  Fermi 2 has performed inspections of portions of the internal core plate differential pressure (ΔP) line. Standby liquid control is also injected through this common line. During the jet pump hold down beam replacement in RF-04 (1994), the accessible core plate ΔP line as well as the standby liquid control piping below the core plate at 180 degrees was visually inspected, and no indications were identified.

  During RF07 (2000), inspections of the nozzle safe-end and adjacent nozzle material were completed per vendor recommendation. These inspections included an ultrasonic as well as a liquid penetrant inspection of the nozzle to safe-end weld. These inspections are also detailed in the ISI Program.

  During outages since 2003, a bare metal inspection was performed on the nozzle safe-end as detailed in BWRVIP-27. No leakage was detected.

  During RF13 in 2009, manual ultrasonic inspections of the nozzle safe-end and adjacent nozzle material were completed with no indications identified.

The history of inspection results indicates that the BWR Penetrations Program has been effective. The continued application of these proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The BWR Penetrations Program has been effective at managing the aging effect of cracking of nickel alloy and stainless steel penetrations. The BWR Penetrations Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.8 BWR STRESS CORROSION CRACKING

Program Description

The BWR Stress Corrosion Cracking Program manages IGSCC in nickel alloy, stainless steel, and cast austenitic stainless steel (CASS) reactor coolant pressure boundary piping and piping welds 4 inches or larger in nominal diameter containing reactor coolant at a temperature above 93°C (200°F) during power operation, regardless of code classification.

Scheduled volumetric examinations provide timely detection of IGSCC and leakage of coolant in accordance with the methods, inspection guidelines, and flaw evaluation criteria delineated in the ASME Code; NUREG-0313, Rev. 2, *Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping*; NRC GL 88-01 and its Supplement 1, *NRC Position on Intergranular Stress Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping;* NRC-approved BWRVIP-75-A; and other requirements specified per 10 CFR 50.55a with NRC-approved alternatives.

The program includes preventive measures such as induction heating stress improvement, solution annealing, and mechanical stress improvement process to minimize stress corrosion cracking.

NUREG-1801 Consistency

The BWR Stress Corrosion Cracking Program is consistent with the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

No plant-specific aging management program issues have been identified for Fermi 2.

Fermi 2 uses on-line noble metal chemistry to mitigate stress corrosion cracking.

The application of proven methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The BWR Stress Corrosion Cracking Program has been effective at managing the aging effect of stress corrosion cracking in nickel alloy, stainless steel, and CASS components. The BWR Stress Corrosion Cracking Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.9 BWR VESSEL ID ATTACHMENT WELDS

Program Description

The BWR Vessel ID [inside diameter] Attachment Welds Program manages cracking in structural welds for BWR reactor vessel internal integral attachments using inspections, scheduling, acceptance criteria, and flaw evaluation in conformance with the requirements of ASME Section XI and guidelines of BWRVIP-48-A. The program includes welds between the vessel wall and vessel ID brackets that attach components to the vessel. The internal attachment weld can be a simple weld or a weld build-up pad on the vessel.

NUREG-1801 Consistency

The BWR Vessel ID Attachment Welds Program is consistent with the program described in NUREG-1801, Section XI.M4, BWR Vessel ID Attachment Welds.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following examples of operating experience provide objective evidence that the BWR Vessel ID Attachment Welds Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- Inspections of the shroud support welds as recommended by BWRVIP-38 were completed in 2001 during RF08. Based on no indications on the core shroud support welds, re-inspection dates were established based on the requirements of BWRVIP-38.
- In 2005, shroud support weld examinations as well as other inspections of reactor vessel internal welds and components were performed as scheduled by the Reactor Vessel Internals Management (RVIM) program. The BWRVIP has developed guidelines for inspection of internal components.
- Portions of the H8 and H9 shroud support welds were last inspected in 2012 during RF15. Gussets are being inspected on a rotating basis each refueling outage, with typically two or more gussets inspected each outage. No indications of cracking have been identified during the inspections.

The history of inspections along with identification of program deficiencies and subsequent corrective actions provide assurance that the BWR Vessel ID Attachment Welds Program will remain effective. The continued application of proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The BWR Vessel ID Attachment Welds Program has been effective at managing the aging effect of cracking of vessel ID attachment welds. The BWR Vessel ID Attachment Welds Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.10 BWR VESSEL INTERNALS

Program Description

The BWR Vessel Internals Program manages cracking, loss of material due to wear, and reduction of fracture toughness for BWR vessel internal components using inspection and flaw evaluation. The program provides (1) determination of the susceptibility of CASS components, (2) accounting for the synergistic effect of thermal aging and neutron irradiation, and (3) implementation of a supplemental examination program, as necessary.

Applicable industry standards and NRC-approved BWRVIP documents provide the basis for scheduling inspections to provide timely detection of aging effects, appropriate NDE inspection techniques, acceptance criteria, flaw evaluation, and repair/replacement, as needed. At Fermi 2, management of the reactor vessel internals is implemented in accordance with ASME Section XI and BWRVIP-94, "BWR Vessel and Internals Project, Program Implementation Guide."

The crack growth rate evaluations and fracture toughness values specified in BWRVIP-14-A, BWRVIP-99-A, and BWRVIP-100-A are used for cracked core shroud welds exposed to the neutron fluence values specified in these BWRVIP reports. This program also addresses aging degradation of CASS and X-750 alloy. Fermi 2 did not use precipitation-hardened (PH) martensitic stainless steel (e.g., 15-5 and 17-4 PH steel) materials or martensitic stainless steel (e.g., 403, 410, 431 steel) in BWR vessel internal components.

NUREG-1801 Consistency

The BWR Vessel Internals Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M9, BWR Vessel Internals.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
4. Detection of Aging Effects	The susceptibility to neutron or thermal embrittlement for reactor vessel internal components composed of CASS and X-750 alloy will be evaluated.

Element Affected	Enhancement
4. Detection of Aging Effects	BWR Vessel Internals Program procedures will be revised as follows. Portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility, neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions) will be inspected, using an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or within five years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size for the initial inspection of susceptible components will be 100 percent of the accessible component population, excluding components that may be in compression during normal operations.
4. Detection of Aging Effects	BWR Vessel Internals Program procedures will be revised as follows. In accordance with an applicant action item for BWRVIP-25 safety evaluation: (a) install core plate wedges prior to the period of extended operation, or (b) complete a plant-specific analysis that justifies no inspections are required or to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25 and submit the inspection plan, along with the acceptance criteria and justification for the inspection plan, to the NRC two years prior to the period of extended operation.

Operating Experience

The following examples of operating experience provide objective evidence that the BWR Vessel Internals Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- During a 2003 inspection of the core spray internal piping, a rub mark indicating movement of the core spray internal piping header was noted. A review of inspection tapes from previous outages identified that movement was previously noted on the right side of the bracket, while the movement on the left side appeared to be recent. As a result of finding this rub mark, the remaining brackets were inspected and no damage was identified. It was determined not to be an operability concern. A follow-up inspection was conducted in 2004 with satisfactory results.

- In 2003, inspections identified cracked retainer screw tack welds. Jet Pump 15 was repaired by the installation of an auxiliary spring wedge. In 2006, inspection identified wear on Jet Pump 2 restrainer bracket. Auxiliary spring wedges were installed on Jet Pumps 1 and 2 and a slip joint clamp was installed on Jet Pump 2 to restore integrity.

- During RF12 inspections in 2007, indications of IGSCC type cracking were identified on an access hole cover at five locations. General Electric performed a detailed flaw evaluation and concluded that the indications would not be expected to grow significantly during the next two cycles, such that the cover welds would fail. This evaluation was updated prior to RF14 using updated load information including the 2009 inspection results from RF13, which did not identify any changes or crack growth of the indications. The evaluation concluded that the access hole cover welds would be acceptable for three additional cycles of operation. During RF14 in 2010, the indications on the access hole cover welds were inspected. There was no change in the appearance of the indications and the evaluation remained valid.

- In 2008, a self-assessment was performed on the BWR Vessels Internal Program that included industry peers. The self-assessment was performed to determine the effectiveness of implementation of the program and the associated inspections. Reviews of the program documents indicated that Fermi 2 is effectively implementing the program. Recommendations for improvement were incorporated into the program where they were determined to be beneficial.

- In 2009, while performing in-vessel visual inspection, an indication was noted on the steam dryer support ring. This indication, at approximately azimuth 22 degrees, runs around the lower edge and onto the horizontal surface of the support ring. No corrective actions were necessary in 2009 based on engineering evaluation. The evaluation stated that the indication in the support ring above the drain channel weld does not adversely affect the integrity of the weld. The weld, which does not have indications, will prevent the generation of loose parts at this location. Based on the inspections performed and the review of this and other steam dryer indications, there is no impact on nuclear, radiological, environmental, or industrial safety, or any risk to generation. The indication was added to the reactor vessel internals indication database.

- In 2009, the Electric Power Research Institute (EPRI) and BWRVIP issued several documents containing “needed” elements as described in NEI 03-08. The BWR Vessel Internals Program was revised to incorporate the needed elements of the new documents either by reference only or by changes to the inspection frequency on selected components. The "good practice" elements of the documents were also reviewed and evaluated for site impact.

- In September 2009, the Institute of Nuclear Power Operations (INPO) reviewed activities at Fermi 2 to promote improvements in key elements of reactor vessel and internals management. The review concluded that the Fermi 2 BWR Vessel Internals Program generally meets BWRVIP guidance. Program implementation is demonstrated through high quality documentation and appropriate monitoring of materiel condition. The component inspection history and long-term inspection plans meet BWRVIP inspection guidance for selection and frequency. There were four beneficial practices noted along with three recommendations. The three recommendations were entered into the Corrective Action Program.

- In 2012, a self-assessment was performed on the program. The self-assessment team identified two strengths, one deficiency, and recommendations from their analysis of the program.

- In 2012, visual inspections were performed on approximately 20 percent of the steam dryer and included the re-inspection of selected hood welds. VT-1 inspections were performed on all critical, high stress welds as recommended by BWRVIP-139-A on the "D" bank as well as a sampling of other locations. Protruding tie rod nut/washer assemblies were monitored on the "D" bank. No changes from previous recorded indications were identified on the steam dryer.

- During RF06, an indication approximately 1¾ inches long was identified on the thermal sleeve to elbow weld (RS-1) on the riser of jet pumps 7/8. This indication was evaluated and found acceptable for continued operation without repair. This indication was reinspected during each refueling outage since RF06, and there continues to be no observable change in length or width of the indication. This indication is within the allowable flaw acceptance tolerance for this location, and repair is not necessary. This indication will be inspected again during RF16.

The BWR Vessel Internals Program has been assessed as GREEN since the second quarter 2011 Program Health Report through the second quarter of 2013.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the BWR Vessel Internals Program will remain effective. The continued application of proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The BWR Vessel Internals Program has been effective at managing aging effects of cracking, loss of material, and reduction of fracture toughness. The BWR Vessel Internals Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.11 COMPRESSED AIR MONITORING

Program Description

The Compressed Air Monitoring Program manages loss of material in compressed air systems by periodically monitoring air samples for moisture and contaminants and by opportunistically inspecting internal surfaces within compressed air systems. Air quality is maintained in accordance with limits established by considering manufacturer recommendations, as well as recommendations in EPRI NP-7079 and TR 108147, ASME OM-S/G-1998 (Part 17), ANSI standard ISA-S7.0.01-1996, and ISA-S7.3. Inspection frequency, acceptance criteria, and design and operating reviews are performed in accordance with NRC GL 88-14. The program was developed using applicable industry standards and documents such as ISA-S7.3, "Quality Standard for Instrument Air," for guidance on preventive measures, inspection of components, and testing and monitoring air quality.

Periodic internal visual inspections of critical components (compressors, dryers, after-coolers, filters, etc.) are performed to detect signs of corrosion. Air quality is monitored and trended to determine if alert levels or limits are being approached or exceeded. Particulates, dew points, hydrocarbon content, and corrosive contaminants are monitored.

NUREG-1801 Consistency

The Compressed Air Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M24, Compressed Air Monitoring, with one exception.

Exceptions to NUREG-1801

The Compressed Air Monitoring Program has the following exception.

Element Affected	Exception
5. Monitoring and Trending	NUREG-1801 recommends the recording and trending of daily readings of system dew point. Dew point testing and trending is performed quarterly.[1]

Exception Note

1. The frequency of dew point testing was reported in the DTE response to GL 88-14 and is based on operating experience, review of site condition reports, and recent system health reports. The operating experience review did not find degradation that has threatened the components' intended function, thus demonstrating adequacy of the dew point testing frequency.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program	Revise Compressed Air Monitoring Program procedures to periodically sample, test, and monitor moisture and corrosive contaminants to verify parameters are within acceptable limits in the EDG starting air system to mitigate aging effects such as loss of material due to corrosion.
2. Preventive Actions 3. Parameters Monitored or Inspected 4. Detection of Aging Effects 6. Acceptance Criteria	Revise Compressed Air Monitoring Program procedures to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters. In addition, include in the Compressed Air Monitoring Program procedures the applicable provision recommended in EPRI NP-7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17 for air system contaminants, inspection frequency, inspection methods, and acceptance criteria for components subject to aging management review that are exposed to compressed air in the following compressed air systems. • Emergency diesel generator (EDG) starting air system • Control air system

Operating Experience

The following examples provide objective evidence that the Compressed Air Monitoring Program will be effective in ensuring that intended functions will be maintained consistent with the current license basis for the period of extended operation.

- In March 2005, the non-interruptible air system (NIAS) exceeded maintenance rule performance criteria. Several functional failures had occurred due to corrosion products in the system entering key isolation valve seats and preventing full and tight closure. The system was placed in maintenance rule category (a)(1) and a plan was developed and implemented to correct the problem. Corrective actions included changing the NIAS normal air source from the station air system to the interruptible air system, providing a higher quality air to NIAS. Other changes included adding filters to the system and changing some carbon steel piping to stainless steel.

- In 2007, external operating experience reports were submitted in which tubing leaks have contributed to events associated with diesel generators. Some of these leaks have been on air supply lines to the emergency diesel generators (EDGs). A walkdown of EDG tubing was performed in 2007 to look for damaged tubing, tubing routinely taken apart that should be replaced, tubing rubbing against something that could lead to wear, tubing not properly restrained in clamps (at an angle), and operation of a valve that could flex tubing. The walkdown identified bent tubing in the EDG starting air system. This tubing was repaired.

- The NRC issued IN 2008-06 related to instrument air system failure resulting in a manual reactor trip at San Onofre Nuclear Generating Station. Based on recommendations, all of the accessible areas of the interruptible air supply were walked down, and no indications of leaks or damaged pipe supports were found.

- In August 2011, a corrective action report was initiated due to unsatisfactory dewpoint readings on the west interruptible air supply dryer. The corrective action process determined that the long term solution is to replace the air dryer controllers. Since the controller is obsolete, an equivalent replacement is being pursued.

  Fermi 2 personnel perform quarterly checks of system dew point for the interruptible air supply (nonsafety-related) and for the non-interruptible air supply (safety-related). All 2011 and 2012 tests results for the non-interruptible air supply have been acceptable. In the same period, three interruptible air supply dew point values were not acceptable, and these were entered into the Corrective Action Program. All dew point values in first quarter 2013 were acceptable.

As discussed in element 10 to NUREG-1801, Section XI.M24, this program considers the technical information and industry operating experience provided in NRC IN 81-38; IN 87-28; IN 87-28, Supplement 1; License Event Report 50-237/94-005-3; NRC GL 88-14; INPO SOER 88-01; EPRI NP-7079; and EPRI TR-108147.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Compressed Air Monitoring Program will remain effective. The application of these proven methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Compressed Air Monitoring Program has been effective at identifying and managing the aging effect of loss of material on the internal surfaces of compressed air systems. The Compressed Air Monitoring Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.12 CONTAINMENT INSERVICE INSPECTION – IWE

Program Description

The Containment Inservice Inspection – IWE (CII-IWE) Program implements the requirements of 10 CFR 50.55a. The regulations in 10 CFR 50.55a impose the inservice inspection (ISI) requirements of the ASME Boiler and Pressure Vessel (B&PV) Code, Section XI, Subsection IWE, for steel containments (Class MC). The Fermi 2 containment design does not include a concrete containment subject to ASME Section XI, Subsection IWL requirements, and therefore the requirements of Class CC are not applicable. There are no tendons associated with Fermi 2's steel containment vessel. The Fermi 2 primary containment is a General Electric Mark I pressure suppression containment and consists of a drywell, a torus (or suppression chamber), and a vent system connecting the drywell and the torus. The code of record for the examination of the Fermi 2 containment, Class MC components and related requirements is in accordance with ASME Code Section XI, Subsections IWE, 2001 Edition with the 2003 Addenda, as mandated and modified by 10 CFR 50.55a.

The scope of the Fermi 2 CII-IWE Program includes the free-standing steel containment vessel and its integral attachments, containment hatches, airlocks, moisture barriers, and pressure-retaining bolting. The program performs visual examinations (general visual, VT-1 and VT-3) to assess the general condition of the containment and to detect evidence of degradation that may affect structural integrity or leak tightness. The visual inspections monitor loss of material of the steel containment vessel surface areas including welds and base metal and containment vessel integral attachments, metal shell, personnel and equipment access hatches, and pressure-retaining bolting. The CII-IWE Program specifies acceptance criteria, corrective actions, and provisions for expansion of the inspection scope when identified degradation exceeds the acceptance criteria.

The CII-IWE Program is a condition monitoring program and does not include guidance for the selection of bolting material, installation torque or tension, and the use of lubricants and sealants. The program is augmented by existing plant procedures to ensure that the selection of bolting material, installation torque or tension, and the use of lubricants and sealants are appropriate for the intended purpose. These procedures will be enhanced to incorporate recommendations delineated in NUREG-1339 and industry recommendations delineated in EPRI documents NP-5769, NP-5067, and TR-104213 to ensure proper specification of bolting material, lubricant, and installation torque.

The containment design employs a General Electric boiling water reactor Mark I design. Therefore, the program addresses the aging management activities of LR-ISG-2006-01 for a BWR Mark I steel containment drywell shell.

NUREG-1801 Consistency

The Containment Inservice Inspection – IWE Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S1, ASME Section XI, Subsection IWE.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
2. Preventive Actions	Revise plant procedures to require inspection of the sand pocket drain lines prior to the period of extended operation. Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. Revise plant procedures to include the preventive actions for storage of American Society for Testing of Materials (ASTM) A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
3. Parameters Monitored or Inspected	Revise plant procedures to specify that inspections of the sand pocket drain lines will monitor the internal condition of the drain lines.
4. Detection of Aging Effects	Revise plant procedures to require visual inspection of sand pocket drain lines to ensure there is no evidence of blockage.
5. Monitoring and Trending	Revise plant procedures to determine drywell shell thickness in the sand pocket areas before the period of extended operation. From the results, develop a corrosion rate to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation.

Element Affected	Enhancement
7. Corrective Actions	Revise plant procedures to require corrective actions should moisture be detected or suspected in the inaccessible area on the exterior of the drywell shell, including: 1) Identify surfaces requiring augmented inspections for the period of extended operation in accordance with Subsection IWE-1240, as identified in Table IWE-2500-1, Examination Category E-C. 2) Use examination methods that are in accordance with Subsection IWE-2500. 3) Demonstrate through use of augmented inspections performed in accordance with Subsection IWE that corrosion is not occurring or that corrosion is progressing so slowly that the degradation will not jeopardize the intended function of the drywell shell through the period of extended operation.

Operating Experience

The following examples provide objective evidence that the CII-IWE Program will be effective in ensuring that intended functions will be maintained consistent with the current license basis for the period of extended operation by performing inspections, identifying and evaluating issues, and addressing operating experience.

Drywell

- Only one corrosion pit has been detected in the drywell shell. The pit, which measured 0.02" x 0.04" x 0.093" deep, was detected during ISI examinations in 2000. The corrosion was attributed to a screw and uncoated washer that were in contact with an uncoated portion of the drywell shell in a beam seat area. The screw and washer were removed. The drywell shell in the area of the pit was coated in 2003.

Sand Pocket Region

The Fermi 2 containment is a General Electric BWR Mark I design with a sand pocket region as is typical for BWR Mark I containments.

- NRC GL 87-05 addressed the potential for corrosion of BWR Mark I steel drywells in the sand pocket region. In response to NRC GL 87-05, Fermi 2 provided the requested information and a technical basis for not performing UT of its drywell shell plates adjacent to the sand pocket region. In summary, Fermi 2 provided the following:

(1) The design of the refueling bellows assembly minimizes the possibility of leakage into the drywell gap. The refueling bellows assembly forms a seal between the drywell and the refueling pool to permit flooding of the refueling pool. The drywell seal bellows consists of a cylindrical, one-piece stainless steel bellows that extends from the drywell shell out to the refueling pool. All seal boundaries consist of welded steel and contain no active components.

(2) At Fermi 2, a different type of coating is utilized for the exterior of the drywell. The full length of the exterior surface of the drywell is coated with Carboline Carbo Zinc 11. This is a self-curing zinc-filled inorganic two-part basic zinc silicate complex that is used to supply galvanic corrosion protection to steel surfaces in marine environments. The coating is insoluble in water and resistant to aggressive water and solvents. Polyurethane foam sheets located within the drywell gap are coated on both sides with an epoxy resin binder to prevent water ingress into the foam. In addition, the Fermi 2 drywell in the vicinity of the sand pocket is 1.5 inches thick.

(3) Walkdowns found no recent indications of moisture in the sand pocket drain lines.

(4) The area directly below the drywell seal bellows contains drain lines. Should the refueling bellows assembly fail, the design minimizes the possibility of water leaking into the sand pocket. Instead, the leakage would enter these drain lines.

- Fermi 2 first noted drainage from the sand pocket drain lines in 1989. Leakage was a minimal one-to-two drops per minute. Analysis of leakage for tritium and gamma emitters indicated that the source was not reactor cavity water. During start up from the refueling outage in September 1992, leakage was still minimal at approximately one drop per minute, and a short period after startup, the leakage was recorded as zero. Leakage has been periodically monitored and has remained at zero since 1993.

- During a refueling outage in 1994, Fermi 2 planned to remove the sand from around the sand pocket drains and expose a small portion of the liner to perform a visual inspection at the four locations. The sand was removed from the sand pocket drain lines, but personnel were unable to inspect the drywell shell due to access limitations of the video probe. The sand in the sand pocket zone was found highly compacted.

- Fermi 2 personnel evaluated NRC Information Notice 2011-15, Steel Containment Degradation and Associated License Renewal Aging Management. The history of sand pocket leakage and the design were evaluated. Based on no leakage being identified for 20 years and the protective coating on the drywell shell, accelerated actions were not deemed warranted. Planning for a boroscope inspection and UT inspection of the shell in the vicinity of the sand pocket was initiated.

- In 2013, all four sand cushion drain lines were internally inspected with a boroscope. There were indications of sand in the bottom of three of the pipes and soft sand at the ends of the pipe. No water was present and the sand would have allowed a drain path through the pipe. In three cases, the boroscope reached the 90-degree elbow at the sand cushion; in the other case, the boroscope could not reach the final foot of the pipe before the elbow because of the presence of sand. There were signs of corrosion in three of the pipes, showing that moisture had been present in the past.

Torus

- IN 2006-01 described a through-wall crack and its probable cause in the torus of a BWR Mark I containment. The cracking identified in the heat-affected zone at the HPCI turbine exhaust pipe torus penetration was most likely initiated by cyclic loading due to condensation oscillation during HPCI operation. The Fermi 2 HPCI design has a turbine exhaust pipe sparger that precludes this condition.
- The torus is inspected in alternate refueling outages. An inspection was performed in 2012, when 100 percent of the torus wetted and vapor space was inspected by qualified NDE inspectors. No pitting of the torus primary containment boundary was identified. One ¼-inch diameter pit has been identified in the torus wetted area during the history of the plant. The pit, a corrosion pit 0.0285 inches in depth, was identified under a coating blister in 2001. The depth of the pit left the remaining shell thickness well within design tolerances. The coating was repaired.
- Coating condition continues to be monitored during inspections. During 2012, broken blisters, mechanical damage, and pinpoint rust areas were identified and repaired in the wetted areas of the torus. In the vapor region, all flaking paint was removed from the torus ring header, torus vacuum breaker valves, nitrogen supply lines, monorail rail, and torus walkway and handrail. Flaking or cracked coating was removed and protective coating was re-applied to the torus shell. As stated above, no pitting of the torus was identified during the 2012 inspections.

As discussed in element 10 to NUREG-1801, Section XI.S1, this program considers the technical information and industry operating experience provided in NRC IN 86-99, IN 88-82, IN 89-79, IN 2004-09, and NUREG-1522. Operating experience is evaluated in accordance with the operating experience program, and relevant information and lessons learned are incorporated into the ISI program documentation.

Operating experience shows that the program has been effective in managing the effects of aging. Therefore, continued application of the proven preventive measures and inspection methods provides reasonable assurance that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The CII-IWE Program detects aging effects using nondestructive examination visual surface techniques to detect and characterize flaws. Also, the CII-IWE Program makes provision to use volumetric examination techniques to detect and characterize flaws. These techniques are widely used and have been demonstrated effective at detecting aging effects during inspections performed to meet ASME Section XI Code requirements. Identification of program deficiencies and subsequent corrective actions provide assurance that the program will remain effective for managing loss of material of components. The continued application of these proven methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.13 CONTAINMENT LEAK RATE

Program Description

The Containment Leak Rate Program consists of tests performed in accordance with the regulations and guidance provided in 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B; Regulatory Guide 1.163, "Performance-Based Containment Leak-Testing Program"; NEI 94-01, "Industry Guideline for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J"; and ANSI/ANS 56.8, "Containment System Leakage Testing Requirements."

Three types of tests are performed under Option B. Type A tests are performed to determine the overall primary containment integrated leakage rate at the loss-of-coolant accident peak containment pressure. Performance of the integrated leakage rate test (ILRT) per 10 CFR Part 50, Appendix J, Option B, demonstrates the leak-tightness and structural integrity of the containment. A general visual examination of the accessible interior and exterior areas of the steel containment vessel is performed prior to any ILRT during a period of reactor shutdown (refueling outages) and during two subsequent refueling outages before the next Type A test. The ILRT is performed at the frequency specified in accordance with 10 CFR Part 50, Appendix J, Option B. Type B and Type C containment local leakage rate tests (LLRT), as defined in 10 CFR Part 50, Appendix J, are intended to detect local leaks and to measure leakage across each pressure-containing or leakage-limiting boundary of containment penetrations. Local leak rate tests are performed at frequencies that comply with the requirements of 10 CFR Part 50, Appendix J, Option B.

The parameters monitored are leakage rates of the steel containment vessel and associated welds, penetrations, fittings, and other access openings. The leakage rate acceptance criteria meet the requirements of 10 CFR Part 50, Appendix J, Option B and are part of the current licensing basis as defined in the plant's Technical Specifications.

The Containment Leak Rate Program does not prevent degradation but provides measures for detection of pressure boundary degradation in various systems penetrating containment. Corrective actions are taken if leakage rates exceed acceptance criteria. The Containment Leak Rate Program detects degradation of the containment shell and liner and components that may compromise the containment pressure boundary, including seals and gaskets. The use of pressure tests verifies the pressure retaining integrity of the containment. The containment leakage rate tests demonstrate the leak-tightness of containment isolation barriers. While satisfactory performance of containment leakage rate tests demonstrates the leak-tightness and structural integrity of the containment, it does not by itself provide information that would indicate that aging degradation has initiated or that the capacity of the containment may have been reduced. This is achieved with the additional implementation of an acceptable containment inservice inspection program as described in ASME Section XI, Subsection IWE (Section B.1.12).

The Containment Leak Rate Program documents and trends test results in accordance with the requirements and guidance provided in 10 CFR Part 50, Appendix J, Option B. The Containment Leak Rate Program demonstrates that the test results meet the requirements contained in the acceptance criteria. Test results that fail to meet the acceptance criteria defined in the plant Technical Specifications are reported in accordance with approved procedures that meet the requirements of 10 CFR 50.72 and 10 CFR 50.73.

Evaluations are performed for test or inspection results that do not satisfy established criteria and corrective action is initiated to document the issue in accordance with plant administrative procedures.

The 10 CFR Part 50, Appendix B Corrective Action Program ensures that the conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to prevent recurrence. Corrective actions are performed in accordance with applicable procedures that meet the requirements of 10 CFR Part 50, Appendix J, Option B.

NUREG-1801 Consistency

The Containment Leak Rate Program is consistent with the program described in NUREG-1801, Section XI.S4, 10 CFR Part 50, Appendix J.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following examples of operating experience provide objective evidence that the Containment Leak Rate Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- In 2007, the integrated leak rate test (ILRT) passed with results well within the acceptable leakage rate. Only with the addition of the leakage through the feedwater check valves was the combined leakage above the acceptance criteria. The ILRT monitors the overall primary containment structure performance.
- In 2007, 13 Fermi 2 valves failed to meet individual acceptance criteria. This test failure rate was higher than previous refueling outage test failure rates and was high compared to the industry. Benchmarking was performed. Acceptance criteria for individual valves

were found more restrictive than acceptance criteria typically used in the industry. Fermi's acceptance criteria were revised to be based on historical leak rate, valve size and service to align Fermi's practices with the industry criteria identified in the benchmarking.

- The Corrective Action Program includes documented cases of individual valves that failed their local leak rate test. These valves were investigated to determine the cause of the test failure and replaced or repaired as necessary. In particular, during the twelfth refueling outage (RF12) in October 2007, leakage through the Fermi 2 feedwater line check valves (B2100F010B and B2100F076B) exceeded the acceptance criterion. The leakage measured for the associated penetration (X- 9B) also caused the calculated as-found integrated leak rate to exceed acceptance criteria. The excessive valve leakage was primarily attributed to erosion of the valve soft seats to the point that the seats were not providing an effective seal. The soft seats were replaced for all four of the feedwater check valves during RF12. The replacement frequency of all feedwater check valve soft seats was increased to every refueling outage. All four valves were retested and met their associated LLRT acceptance criteria prior to restart of the unit. A review of this situation found that the intended function of the primary containment associated with containment isolation valves (i.e., to limit the release of fission products in the event of a postulated design basis loss of coolant accident so that offsite and control room occupant doses do not exceed the limits of 10 CFR 50.67 or 10 CFR 100) was not impacted.

- One inboard feedwater check valve failed its LLRT in 2009. The soft seats were replaced on all four feedwater check valve containment isolation valves. In 2010, all feedwater check valves passed their as-found LLRTs. A modification was implemented for the inboard feedwater check valves to replace the soft seats with a hard seat articulating disc design. In 2012, all feedwater check valves passed as-found LLRTs, demonstrating effective corrective action.

- Since RF13 in 2009, the combined as-found leak rate has passed the acceptance criteria. Three individual valves in RF13 had significant leakage (one was the feedwater valve), but the outboard valves in the penetrations were leak tight. There were no LLRTs with significant leakage in 2010 or in 2012, demonstrating improving performance.

- All as-found Type B tests from 2003 to 2013 passed their individual acceptance criteria. The as-left leakage on an equipment hatch was above the individual acceptance criteria in 2009, but considered acceptable as is, since the sum of individual LLRT leakage rates was well below the acceptance limit. During the next refueling outage in 2010, the seals were replaced on the southwest drywell hatch.

The history of identification of degradation and initiation of corrective action, along with identification of program deficiencies and subsequent corrective actions, provide reasonable assurance that the Containment Leak Rate Program will remain effective for managing loss of material of containment pressure boundary components. The continued application of proven testing methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Containment Leak Rate Program has been effective at identifying and managing the aging effects of the pressure-retaining steel components and their integral attachments. The Containment Leak Rate Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

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.

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.

The One-Time Inspection Program describes inspections planned to verify that the Diesel Fuel Monitoring Program has been effective at managing aging effects.

NUREG-1801 Consistency

The Diesel Fuel Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M30, Fuel Oil Chemistry.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
2. Preventive Actions 3. Parameters Monitored or Inspected 4. Detection of Aging Effects 5. Trending 6. Acceptance Criteria 7. Corrective Actions	Revise Diesel Fuel Monitoring Program procedures to monitor and trend water and sediment, particulates, and levels of microbiological organisms in the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and combustion turbine generator (CTG) fuel oil tank quarterly. In addition, revise program procedures to state that biocides or corrosion inhibitors may be added as a preventive measure or are added if periodic testing indicates biological activity or evidence of corrosion, respectively.
4. Detection of Aging Effects	Revise the Diesel Fuel Monitoring Program procedures to include a ten-year periodic cleaning and internal visual inspection of the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank with the following instructions. The cleanings and internal inspections will be performed at least once during the ten-year period prior to the period of extended operation and at succeeding ten-year intervals. If visual inspection is not possible, perform a volumetric inspection. If evidence of degradation is observed during visual inspection, perform a volumetric examination of the affected area.

Operating Experience

The Fermi 2 Diesel Fuel Monitoring Program has been effectively managing the quality of the diesel fuel supplied to the EDGs, CTG and diesel fire pump engine. The following examples of operating experience demonstrate the effectiveness of the program.

- Due to suspected fuel contamination, the CTG fuel oil storage tank was drained, cleaned, and inspected in April 2000. Minor pitting was repaired, and an epoxy liner was installed on the tank floor to protect against further pitting. Fermi 2 instituted measures to periodically drain and inspect the tank internals.

- The CTG oil tank is sampled monthly. A visual observation and moisture analysis are performed to check for contaminants. Only one monthly sample in the last five years (in June 2009) was above the acceptance criteria for moisture, and when a water and sediment analysis was performed on the sample, it was within the specification.
- Every ten years, the EDG main fuel oil storage tanks are drained and cleaned. During the last inspection in 2006, no degradation due to the effects of aging was noted.
- Monthly oil samples for particulates from the four EDG main fuel oil storage tanks have been within specifications for the past five years.
- Monthly oil samples for water and sediment from the diesel fire pump fuel oil tank have been within specifications for the past five years.
- In 2008, a new fuel shipment contained high levels of particulates. This shipment was rejected. A new fuel shipment was also rejected due to particulate content in 2011. No shipments have been rejected due to high levels of particulates since that time.
- In 2009, the program was modified to require multi-level samples of the CTG and EDG main fuel oil storage tanks rather than a single sample from the bottom of the tank. The multi-level stratification sampling is performed annually.

The results of recent diesel fuel sampling and tank inspections indicate that the Diesel Fuel Monitoring Program has been effective. The continued application of proven sampling and inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Diesel Fuel Monitoring Program has been effective at managing the aging effect of loss of material of components exposed to diesel fuel oil. The Diesel Fuel Monitoring Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.15 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRIC COMPONENTS

Program Description

The Environmental Qualification (EQ) of Electric Components Program is an existing program. The NRC has established nuclear station EQ requirements in 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments (that is, those areas of the plant that could be subject to the harsh environmental effects of a loss of coolant accident [LOCA], high energy line breaks [HELBs] or high radiation) are qualified to perform their safety function in those harsh environments. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification.

As required by 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluation. Reanalysis of an aging evaluation addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions. Some aging evaluations for EQ components are time-limited aging analyses (TLAAs) for license renewal.

EQ Component Reanalysis Attributes

The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of an EQ program. While a component life limiting condition may be due to thermal, radiation, or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to the station's quality assurance program requirements that require the verification of assumptions and conclusions. As already noted, important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those applied during the prior evaluation. The Arrhenius methodology is an acceptable thermal model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, one acceptable method of establishing the 60-year normal radiation dose is to multiply the 40-year normal radiation dose by 1.5 (that is, 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. Other models may be justified on a case-by-case basis.

Data Collection and Reduction Methods: Reducing excess conservatism in the component service conditions (for example, temperature, radiation, cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation is to be conservative and based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for Technical Specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation, or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging.

Underlying Assumptions: EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken that may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Actions: The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component is to be refurbished, replaced, or requalified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace, or requalify the component if the reanalysis is unsuccessful).

NUREG-1801 Consistency

The Environmental Qualification (EQ) of Electric Components Program is consistent with the program described in NUREG-1801, Section X.E1, Environmental Qualification (EQ) of Electric Components.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

Operating experience shows that this program has been effective in managing aging effects. Fermi 2 EQ Program personnel participate in EQ industry working groups like Nuclear Utility Group on Equipment Qualification (NUGEQ), Equipment Qualification Data Base (EQDB), Electric Power Research Institute (EPRI), etc., to share operating experience, including experience with aging effects of EQ components.

- A 2012 focused self-assessment identified one strength, and twelve corrective action documents were written on deficiencies and recommendations. None of the deficiencies involved failure to maintain equipment environmental qualification.
- A project began in 2012 to update the EQ program files. The majority of file updates were completed in 2013.
- In 2012, Fermi 2 identified missing environmental qualification bases documentation for conduit seals that use EYS fittings filled with Ren Plastic sealant for safety-related applications. This was a deficiency in EQ documentation with respect to qualification bases for EQ seal materials. This condition was discovered during the EQ basis reconstitution project in 2012. Several corrective actions were completed in response to this condition. These corrective actions included reviewing test reports to ensure the EQ bases were complete, revising an electrical design specification, and updating the plant equipment database.

Continued implementation of the program provides reasonable assurance that equipment qualification will be maintained and the effects of aging will be managed so that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation. Performing self-assessments and program initiatives, such as the EQ program basis reconstitution, will provide added assurance of the continued effectiveness of the program.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Environmental Qualification (EQ) of Electric Components Program has been effective at managing aging effects by maintaining equipment within its qualification basis. The Environmental Qualification (EQ) of Electric Components Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.16 EXTERNAL SURFACES MONITORING

Program Description

The External Surfaces Monitoring Program manages aging effects of components fabricated from metallic, elastomeric, and polymeric materials through periodic visual inspection of external surfaces during system inspections and walkdowns for evidence of leakage, loss of material (including loss of material due to wear), cracking, fouling, and change in material properties. When appropriate for the component and material, physical manipulation, such as touching, pressing, flexing, and bending, is used to augment visual inspections to confirm the absence of hardening and loss of strength in non-metallic materials. The External Surfaces Monitoring Program is also credited in an air – indoor and air – outdoor environment where the material and environment combinations are the same for the internal and external surfaces such that the external surfaces are representative of the internal surfaces.

Inspections are performed at a frequency of at least once per refueling cycle by personnel qualified through plant-specific programs. Deficiencies are documented and evaluated under the Corrective Action Program. Surfaces that are not readily visible during plant operations and refueling outages are inspected when they are made accessible and at such intervals that would ensure the components' intended functions are maintained. Surfaces that are insulated are inspected when exposed at such intervals to ensure the components' intended functions are maintained.

Examples of inspection parameters for metallic components include the following:

- Corrosion (loss of material).
- Leakage from or onto external surfaces (loss of material).
- Worn, flaking, oxide-coated surfaces (loss of material).
- Corrosion stains on thermal insulation (loss of material).
- Protective coating degradation (cracking, flaking, and blistering).
- Leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides (cracking).

Examples of inspection parameters for non-metallics include the following:

- Surface cracking, crazing, scuffing, and dimensional change (e.g., ballooning and necking).
- Discoloration.
- Exposure of internal reinforcement for reinforced elastomers.
- Hardening as evidenced by a loss of suppleness during manipulation where the component and material are appropriate for manipulation.
- Shrinkage, loss of strength.

For polymeric materials, the visual inspection will include 100 percent of the accessible components. The sample size of polymeric components that receive physical manipulation is at least ten percent of the available surface area.

Acceptance criteria are defined to ensure that the need for corrective action is identified before a loss of intended function. For stainless steel, a clean shiny surface is expected. For flexible polymers, a uniform surface texture (no cracks) and no change in material properties (e.g., hardness, flexibility, physical dimensions, color changed from when the material was new) are expected. For rigid polymers, no surface changes affecting performance such as erosion, cracking, crazing, checking, and chalking, are acceptable.

NUREG-1801 Consistency

The External Surfaces Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M36, External Surfaces Monitoring of Mechanical Components, as modified by LR-ISG-2011-03 and LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation."

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program	Revise External Surfaces Monitoring Program procedures to clarify that periodic inspections will be performed of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2).

Element Affected	Enhancement
3. Parameters Monitored or Inspected 4. Detection of Aging Effects	Revise External Surfaces Monitoring Program procedures to inspect 100 percent of accessible components at least once per refueling cycle and to ensure required walkdowns include instructions to inspect for the following related to metallic components: • Corrosion (loss of material and fouling). • Leakage from or onto external surfaces (loss of material). • Worn, flaking, or oxide-coated surfaces (loss of material). • Corrosion stains on thermal insulation (loss of material). • Protective coating degradation (cracking, flaking, and blistering). • Leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides (cracking).
3. Parameters Monitored or Inspected 4. Detection of Aging Effects	Revise External Surfaces Monitoring Program procedures to include instructions for monitoring aging effects for flexible polymeric components through physical manipulations of the material, with a sample size for manipulation of at least ten percent of the available surface area. Inspect accessible surfaces for the following: • Surface cracking, crazing, scuffing, dimension changes (e.g., ballooning and necking). • Discoloration. • Exposure of internal reinforcement for reinforced elastomers. • Hardening as evidenced by loss of suppleness during manipulation where the component and material are appropriate to manipulation. • Shrinkage, loss of strength.
4. Detection of Aging Effects	Revise External Surfaces Monitoring Program procedures to ensure surfaces that are insulated will be inspected when the external surface is exposed (i.e., during maintenance).

Element Affected	Enhancement
6. Acceptance Criteria	Revise External Surfaces Monitoring Program procedures to include acceptance criteria for the parameters observed. • Metals should not have any indications of relevant degradation. • Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color. • Rigid polymers should have no erosion, cracking, crazing, or chalking.
9. Administrative Controls	Revise External Surfaces Monitoring Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Operating Experience

The following examples provide objective evidence that the External Surfaces Monitoring Program provides reasonable assurance that degradation is identified and addressed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

- During a system walkdown in 2009, a leak was identified from a pipe cap near a filter demineralizer drain valve. The cap was tightened.
- During a walkdown in the reactor building in 2010, water was observed in a dike near a shield block wall. The source of the leakage was a reactor water cleanup system valve. The leak was repaired.
- During a system walkdown of CCHVAC Division 2 mechanical room in 2011, an engineer noticed that an air seal gasket between the concrete wall and shielding blocks was bulging in an area 12 inches long and 2 inches deep. The joint was intact, but this anomaly was entered into the Corrective Action Program. The seal was repaired.
- During a system walkdown in 2012, insulation was discovered missing from the core spray pump C suction piping. The insulation was installed.
- During a system walkdown in 2012, a three-drop-per-minute leak was observed from a valve packing. Maintenance tightened the valve packing to stop the leak.

As discussed in element 10 to NUREG-1801, Section XI.M36, this program considers the industry operating experience from many utilities since the mid 1990's in support of the maintenance rule (10 CFR 50.65) and has proven effective in maintaining the material condition of plant systems.

The history of identification of degradation and initiation of corrective action prior to loss of intended function provides assurance that the External Surfaces Monitoring Program will remain effective. The continued application of proven monitoring methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The External Surfaces Monitoring Program has been effective at managing aging effects of loss of material, loss of material due to wear, cracking, fouling, and change of material properties on external and internal surfaces that may result in leakage. The External Surfaces Monitoring Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.17 FATIGUE MONITORING

Program Description

The Fatigue Monitoring Program ensures that fatigue usage remains within allowable limits for components identified to have a TLAA by (a) tracking the number of critical thermal and pressure transients for selected components, (b) verifying that the severity of monitored transients are bounded by the design transient definitions for which they are classified, (c) assessing the impact of the reactor coolant environment on a set of sample critical components including those from NUREG/CR-6260 and those components identified to be more limiting than the components specified in NUREG/CR-6260, and (d) addressing applicable fatigue exemptions. Tracking the number of critical thermal and pressure transients for the selected components ensures a code design usage factor of less than or equal to 1, including environmental effects where applicable. The environmental effects on fatigue for the identified critical components will be evaluated.

The program monitors the number of occurrences for the plant transients that cause significant fatigue usage. The program also provides for updates of fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified.

NUREG-1801 Consistency

The Fatigue Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section X.M1, Fatigue Monitoring, with the following exception.

Exceptions to NUREG-1801

The Fatigue Monitoring Program has the following exception.

Element Affected	Exception
7. Corrective Actions	NUREG-1801 recommends use of a design code limit for cumulative usage factors (CUFs). Fermi 2 applied more stringent design limits at high energy line break (HELB) locations. Also, Fermi 2 includes an additional corrective action to evaluate the HELB analysis to address a HELB exclusion location with a CUF that increases to greater than the limit.[1]

Exception Note

1. The use of a lower limit for CUF at HELB locations is consistent with the criteria stated in UFSAR Section 3.6.1.2. Evaluation of the HELB analysis is an additional valid corrective action to address HELB exclusion locations with a CUF that increases to greater than the limit.

Enhancements

The environmentally assisted fatigue (EAF) usage calculation enhancement (second below) will be implemented at least two years prior to entering the period of extended operation. All other enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program 2. Preventive Actions 3. Parameters Monitored or Inspected 5. Monitoring and Trending	Revise Fatigue Monitoring Program procedures to monitor and track critical thermal and pressure transients for components that have been identified to have a fatigue TLAA.
1. Scope of Program 2. Preventive Actions 6. Acceptance Criteria	Develop EAF usage calculations that consider the effects of the reactor water environment for a set of sample reactor coolant system components. This sample set will include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they are found more limiting than those considered in NUREG/CR-6260. Environmental correction factors will be determined using formulae consistent with those recommended in NUREG-1801, X.M1.
4. Detection of Aging Effects	Revise Fatigue Monitoring Program procedures to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified. For components with assumed minimal cycle counts, ensure that exemption assumptions are not exceeded.
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.

Operating Experience

The following examples of operating experience provide objective evidence that the Fatigue Monitoring Program provides reasonable assurance that the effects of aging due to fatigue are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

- In 1998, transient cycles were approaching the cycle limits. The condition was entered into the Corrective Action Program for trending and corrective measures. A design calculation was performed to increase the allowable number of startup and shutdown cycles.
- In 2012, Fermi 2 initiated an independent evaluation of the transient cycle events and cycle counts to improve effectiveness of the Fatigue Monitoring Program. New or revised analysis assumptions will be factored into the Fatigue Monitoring Program, as necessary.
- No loss of intended function due to thermally induced fatigue has been identified at Fermi 2.

The history of monitoring cycle counts and initiating corrective action to maintain validity of associated fatigue analyses provides reasonable assurance that the Fatigue Monitoring Program will remain effective. The continued application of this proven monitoring approach provides assurance that the associated analyses will remain valid or that appropriate corrective actions will be taken such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Fatigue Monitoring Program has been effective in managing the effects of aging due to fatigue. The Fatigue Monitoring Program provides reasonable assurance that the effects of aging due to fatigue are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.18 FIRE PROTECTION

Program Description

The Fire Protection Program manages the following through periodic visual inspection of components and structures with a fire barrier intended function.

- Carbon steel components (loss of material).
- Concrete components (cracking and loss of material).
- Masonry walls (cracking and loss of material).
- Fire resistant materials (loss of material, change in material properties, cracking/ delamination, and separation).
- Elastomer components (increased hardness, shrinkage, and loss of strength).

The program includes visual inspections of not less than ten percent of each type of penetration seal at a frequency described in the Technical Requirements Manual (TRM). These inspections examine any sign of degradation, such as cracking, seal separation from walls and components, separation of layers of material, rupture and puncture of seals that are directly caused by increased hardness, and shrinkage of seal material due to loss of material. If any signs of degradation are detected within the sample, the scope of the inspection is expanded to include additional seals.

Visual inspections of fire barrier walls, ceilings, and floors in structures within the scope of license renewal are performed at a frequency described in the TRM. Inspections of fire barriers include inspections of coatings and wraps. Visual inspection of fire barrier walls, ceilings, and floors and other fire barrier materials to detect any sign of degradation, such as cracking and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates, are performed to ensure their intended fire protection functions are maintained.

Periodic visual inspections and functional tests are utilized to manage the aging effects of fire doors. Visual inspections of fire door surfaces and functional testing of fire door closing mechanisms and latches are performed at a frequency described in the TRM.

The Fire Protection Program performs visual periodic inspections and functional tests of the CO_2 and Halon systems in accordance with the TRM. These actions verify that the systems actuate correctly and that system integrity is maintained by inspecting for conditions of corrosion that could lead to a loss of material.

NUREG-1801 Consistency

The Fire Protection Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M26, Fire Protection.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program 4. Detection of Aging Effects	Revise Fire Protection Program procedures to perform visual inspections to manage loss of material of the Halon and CO_2 fire suppression system.
4. Detection of Aging Effects	Revise Fire Protection Program procedures to require visual inspections of in-scope (a) fire wrap and fire stop materials constructed of fibersil cloth, cerafoam, kaowool, thermolag, flamemastic, and pyrocrete for loss of material, change in material properties, cracking/delamination, separation, increased hardness, shrinkage, and loss of strength; (b) carbon steel penetration sleeves for loss of material; (c) steel framing, roof decking, and floor decking for loss of material; (d) concrete fire barriers including manways, manhole covers, handholes, and roof slabs for loss of material and cracking; and (e) railroad bay airlock doors for loss of material. Inspections are performed at a frequency in accordance with the NRC-approved fire protection program or at least once every refueling cycle.

Operating Experience

Nuclear Electric Insurance Limited (NEIL) reported on the fire protection program in October of 2011, September of 2012, and October of 2013. These reports determined compliance with the requirements of the NEIL property loss control standards. The findings of these evaluations relate mainly to housekeeping and control of transient combustibles. Some issues in 2013 related to the maintenance of kitchen hood and machine shop equipment. There were no issues found related to aging of fire barriers or fire protection features and no issues found related to the CO_2 system.

Integrated inspections were performed by the NRC on March 31, 2012; June 30, 2012; and September 30, 2012. The results of these inspections state that fire doors, dampers, and penetration seals appeared to be in satisfactory condition.

The NRC triennial fire protection inspection performed in 2011 did not find any issues related to aging of fire barriers or fire protection features and no issues found related to the CO_2 system with the exception of heat detectors in the EDG rooms.

Fermi 2 personnel have identified small holes in fire doors, damaged fire door seals, damaged fire walls, or damaged penetrations seals. When these deficiencies are noted, a fire impairment is declared, and maintenance personnel repair the deficiency.

In 2009, while performing fire protection inspections, eight fire penetration seals in the reactor building steam tunnel floor were found cracked due to heat stress. Inspections look for these occurrences, which are caused by mechanical damage due to pipe movement and the elevated temperature. A fire protection engineering evaluation (FPEE) was prepared that documents the historical record of the failure of these seals and the acceptability of the fire barrier penetration seals between the turbine building and the torus room. The FPEE concluded that the seals deviate from their rated design because they are utilized in conditions beyond their design capabilities due to their exposure to pipe movement and extreme temperatures during normal plant operations. This results in the seals degrading during the interval between surveillances. However, the FPEE further concluded that the seals are acceptable due to the extremely low fire loading in the area and the presence of an automatic sprinkler system below the steam tunnel in the reactor building basement. The FPEE requires that penetration seals found to be degraded are repaired.

As discussed in element 10 to NUREG-1801, Section XI.M26, this program considers the technical information and industry operating experience provided in NRC IN 88-56, IN 94-28, IN 97-70, IN 91-47 and NRC GL 92-08.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Fire Protection Program will remain effective. The continued application of these proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Fire Protection Program has been effective at managing the aging effects of cracking, loss of material, delamination, separation, and change in material properties (e.g., increased hardness, shrinkage, loss of strength) on the external surfaces of fire protection components. The Fire Protection Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.19 FIRE WATER SYSTEM

Program Description

The Fire Water System Program manages loss of material and biofouling for components in fire water systems using preventive, inspection, and monitoring activities, including periodic flush tests and testing or replacement of sprinkler heads. Applicable industry standards and guidance documents are used to delineate the program.

Consistent with National Fire Protection Association Standard 25 (NFPA-25), the Fermi 2 program includes system performance testing in accordance with the UFSAR and TRM. The periodic flow testing includes monitoring the pressure of tested pipe segments, which verifies that system pressure remains adequate for system intended functions. Results are trended. Periodic flushing is also performed in accordance with the TRM.

Wall thickness is evaluated to ensure minimum wall thickness is maintained. Wall thickness measurements are determined by volumetric testing, or as an alternative to nonintrusive testing, by visually monitoring internal surface condition upon each entry into the system for routine or corrective maintenance. The use of internal visual inspections is acceptable when inspections can be performed (based on past maintenance history) on a representative number of locations. These inspections will be performed before the period of extended operation and at plant-specific intervals, based on the initial test results, during the period of extended operation. Periodic visual inspections of fire water system internals monitor surface condition for indication of loss of material or biofouling.

Other requirements of the program include testing and maintaining fire detectors and visually inspecting fire hydrants to detect signs of corrosion. Fire hydrant flow tests are performed annually to ensure fire hydrants can perform their intended function. Water system pressure is continuously monitored such that loss of pressure is immediately detected and corrective action initiated. If not replaced, sprinkler heads are tested before the end of 50-year sprinkler service life and every ten years thereafter during the period of extended operation.

Program acceptance criteria are (a) the water-based fire protection system can maintain required pressure, (b) no unacceptable signs of degradation are observed during nonintrusive or visual inspections, (c) minimum design pipe wall thickness is maintained, and (d) no biofouling exists in the sprinkler systems that could cause corrosion in the sprinklers.

NUREG-1801 Consistency

The Fire Water System Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M27, Fire Water System.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
3. Parameters Monitored or Inspected	Revise Fire Water System Program procedures to include periodic visual inspection of fire water system internal surface condition for evidence of loss of material.
4. Detection of Aging Effects	Revise Fire Water System Program procedures to include one of the following inspection options. • Wall thickness evaluations of fire protection piping using nonintrusive techniques (e.g., volumetric testing) to identify evidence of loss of material will be performed prior to the period of extended operation and periodically thereafter. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function. OR • A visual inspection of the internal surface condition of a representative sample of fire protection piping will be performed. The visual inspections can be opportunistic or planned as needed to obtain a representative sample prior to the period of extended operation. The frequency of inspections during the period of extended operation will be determined through an engineering evaluation of the results of previous inspections of fire water piping.

Element Affected	Enhancement
4. Detection of Aging Effects	Revise Fire Water System Program procedures to include testing or replacement of sprinkler heads. If testing is chosen, a representative sample of sprinkler heads will be tested before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the period of extended operation. NFPA-25 defines a representative sample of sprinklers. If replacement of the sprinkler heads is chosen, all sprinklers that have been in service for 50 years will be replaced.
6. Acceptance Criteria	Revise Fire Water System Program procedures to include inspection of fire water system internals for no unacceptable signs of degradation observed during non-intrusive or visual inspection of components and no biofouling found in the sprinkler systems that could cause corrosion in the sprinklers.

Operating Experience

The following operating experience provides objective evidence that the Fire Water Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

- In 2004, a compliance review of NFPA 14 was performed. A noncompliance was identified related to the provision that piping in a standpipe system which normally remains dry shall be pressure tested at intervals of not more than five years. The general service water pump house has a fire department connection on the outside wall, which is connected to the main fire protection piping with a short section of piping and a check valve inside the pump house. This section remains dry and is a required part of the Fermi 2 standpipe and hose system. This normally dry piping and the fire department connection were not being routinely inspected or tested on a periodic basis. Based on the compliance review, a recurring activity was created with a critical completion period of every 1830 days to perform this test to maintain compliance with NFPA 14.
- In 2008, a fire suppression water system flow test was performed. The flow test revealed degradation of flow in the 12-inch diameter underground piping from what was observed during the previous test. Fire protection engineering had been trending the degradation of the piping and determined that the flow factor had continued to decrease, which could result in a system degraded such that it would not be capable of performing its function of supplying the sprinkler systems with adequate flow and pressure. Based on this result, Fermi 2 increased the frequency of testing and evaluation of this piping.

- In 2009, an opportunistic inspection of the fire water system was conducted. Internal corrosion tubercules were observed. Tubercules were removed from approximately one square foot of piping, exposing general corrosion with some isolated pitting. The condition was found acceptable for continued service, and an above-ground location on the system was selected for monitoring to determine internal corrosion rates.

- During continued monitoring and trending of plant test data in 2010, the test procedures were revised to provide more accurate and consistent test results. Hydraulic gradient testing was instituted to serve as a diagnostic and trending tool.

- The NRC triennial fire protection inspection performed in 2011 did not find any issues related to aging of the fire water system.

- NEIL reported on the fire protection program in October 2011 and September 2012. These reports determined compliance with the provisions of the NEIL property loss control standards. A review of the maintenance and testing procedures for the sprinkler systems and deluge systems was performed and indicated that good maintenance and operability testing in accordance with station procedures was being performed.

- In 2011, following analysis of the C factor of the underground fire header, a reduction in margin was observed. This reduction has been evaluated in an FPEE, and the underground header continues to meet its design function. The condition of the fire header continues to be monitored.

- In 2012, the fire suppression system flow test failed acceptance criteria. Corrective actions included repeating the test, determining the cause of reduced flow, and determining the method to eliminate the recurrence of the fire header flow restriction. The restriction appeared to be due to silting in the pipes. A flush was performed on December 13, 2012. This flush was different than flushes in the past in that several hydrants across the site were used, and the closest isolation valve downstream of each hydrant was closed. The purpose of this method was to get a more localized flushing rather than flush the whole system through one hydrant. On December 14, 2012, the flow test was repeated. Because the tested residual pressure exceeded the minimum required pressure for the given flow rate, the flow test results were determined to be acceptable.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Fire Water System Program will remain effective. The continued application of these proven inspection and testing methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Fire Water System Program has been effective at identifying and managing aging effects of loss of material and biofouling of the internal surfaces of fire protection components that contain water used for fire suppression. The Fire Water System Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.20 FLOW-ACCELERATED CORROSION

Program Description

The Flow-Accelerated Corrosion (FAC) Program manages loss of material due to wall thinning caused by FAC for carbon steel piping and components through (a) performing an analysis to determine systems susceptible to FAC, (b) conducting appropriate analysis to predict wall thinning, (c) performing wall thickness measurements based on wall thinning predictions and operating experience, and (d) evaluating measurement results to determine the remaining service life and the need for replacement or repair of components.

The program relies on implementation of guidelines published by EPRI in Nuclear Safety Analysis Center NSAC-202L, Rev. 3, "Recommendations for an Effective Flow Accelerated Corrosion Program," and internal and external operating experience. The program uses a predictive code for portions of susceptible systems with design and operating conditions that are amenable to computer modeling. When field measurements identify that the predictive code is not conservative, the model is recalibrated. The model is also adjusted as a result of any power uprates.

The program also manages wall thinning due to various erosion mechanisms in treated water or steam systems for all materials that may be identified through industry or plant-specific operating experience.

A representative sample of components is selected based on the most susceptible locations for wall thickness measurements at a frequency in accordance with NSAC-202L Rev. 3 guidelines to ensure that FAC degradation is identified and mitigated before the component integrity is challenged. Inspections are performed using ultrasonic or other approved testing techniques capable of detecting wall thickness. Measurement results are used to confirm predictions and to plan long-term corrective action. In the event measurements of wall thinning exceed predictions, the extent of the wall thinning is determined as a part of the Corrective Action Program. Components predicted to reach the minimum allowed wall thickness before the next scheduled outage are isolated, repaired, replaced, or reevaluated under the Corrective Action Program.

NUREG-1801 Consistency

The Flow-Accelerated Corrosion Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M17, Flow-Accelerated Corrosion, as modified by LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms."

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program 4. Detection of Aging Effects 5. Monitoring and Trending 7. Corrective Actions	Revise FAC Program procedures to indicate that the FAC Program also manages loss of material due to erosion mechanisms of cavitation, flashing, liquid droplet impingement, and solid particle erosion for any material in treated water or steam environments. Include in program procedures a susceptibility review based on internal operating experience; external operating experience; EPRI TR-1011231, *Recommendations for Controlling Cavitation, Flashing, Liquid Droplet Impingement, and Solid Particle Erosion in Nuclear Power Plant Piping*; and NUREG/CR-6031, *Cavitation Guide for Control Valves*. Piping subject to erosive conditions is not excluded from inspections, even if it has been replaced with FAC-resistant material. Periodic wall thickness measurements of such piping should continue until the effectiveness of corrective actions is assured.
7. Corrective Actions	Revise FAC Program procedures to specify that downstream components are monitored for wall thinning when susceptible upstream components are replaced with FAC-resistant materials.

Operating Experience

The following examples of operating experience provide objective evidence that the FAC Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- In 2006, condenser nozzle 27 was cut at the condenser wall as planned due to impingement damage. Based on the degree of wear of the remaining piping, the entire section of pipe was replaced.
- In 2008, a self-assessment of the FAC program was performed. This self-assessment was performed to determine the gaps between the FAC program at Fermi 2 and the INPO FAC Program guide (EPG-06). The self-assessment concluded that overall the FAC

program is good. Program strengths were identified. Seven recommendations were also identified. The recommendations were entered into the Corrective Action Program.

- In 2007 and 2009, wear was detected in the emergency drain lines for 5N and 5S feedwater heaters. Replacement of the emergency drain lines is scheduled for RF18.
- In 2009, 2010, and 2012, indications of FAC were observed in the moisture separator reheaters (MSRs). The MSR inspection frequency was increased to better monitor for FAC in the MSRs.
- In 2010, two independent gap studies and a QA surveillance were performed to compare the INPO engineering program guide EPG-06 to the Fermi 2 FAC program. Gaps were identified and entered into the Corrective Action Program for evaluation and resolution.
- In 2011, a comprehensive self-assessment was conducted over the course of three days by a cross-organizational team of eight individuals, which included an EPRI FAC consultant, two industry peers from Davis-Besse, and four internal peers from Fermi 2. Recommendations and deficiencies identified by the self-assessment team were entered into the Corrective Action Program.

As discussed in element 10 to NUREG-1801, Section XI.M17, this program considers the technical information and industry operating experience provided in NRC IE Bulletin No. 87-01, NRC IN 92-35, IN 95-11, IN 2006-08, IN 97-84, IN 89-53, IN 91-18, IN 93-21, IN 97-84, and Licensee Event Report 50-237/2007-003-00.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Flow-Accelerated Corrosion Program will remain effective. The continued application of proven monitoring methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Flow-Accelerated Corrosion Program has been effective at identifying and managing aging effects of loss of material due to flow-accelerated corrosion and erosion. The Flow-Accelerated Corrosion Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.21 INSERVICE INSPECTION

Program Description

The Inservice Inspection (ISI) Program manages loss of material, cracking, and reduction in fracture toughness for ASME Class 1, 2, and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting, using volumetric, surface, and/or visual examination and leakage testing as specified in ASME Code Section XI, 2001 Edition with 2003 Addenda.[1] The examinations, scheduling, acceptance criteria, flaw evaluation, and re-examinations are in accordance with the requirements identified in ASME Section XI with NRC-approved alternatives.

Additional limitations, modifications, and augmentations approved under the provisions of 10 CFR 50.55a with NRC-approved alternatives are included as a part of this program. Every ten years this program is updated to the latest ASME Section XI code edition and addendum approved by the NRC per 10 CFR 50.55a. Repair and replacement activities for these components are covered in Subsection IWA of the ASME code edition of record.

NUREG-1801 Consistency

The Inservice Inspection Program is consistent with the program described in NUREG-1801, Section XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following examples of operating experience provide objective evidence that the ISI Program will continue to be effective in assuring that intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- From the fourth quarter of 2002 through the second quarter of 2013, the overall health of the ISI Program has been stable with a GREEN rating.
- In 2012, 44 components were inspected with no significant issues identified.

1. Refer to NUREG-1801, Chapter 1, for applicability of other editions of the ASME Code, Section XI.

- From August 2007 through March 2010, a vendor provided engineering services to DTE Energy to update the ISI Program for Fermi 2. The primary objective was to produce an ISI-NDE program plan for the upcoming third interval along with any associated requests for alternatives and relief requests for submittal to the NRC. A secondary objective accomplished during this update process was to generate the supporting documents needed to implement the program as efficiently as possible during the upcoming ten-year interval. To accomplish this objective, numerous documents were reviewed, evaluated, and updated. In addition, a number of new program documents were created to incorporate information that was made available since the previous program updates. These documents included a 10 CFR 50.55a regulatory review, code comparisons, code case evaluation, augmented examination evaluation, and selection guideline.

- In 2008, a self-assessment of the second ten-year interval ISI-NDE plan was performed. This was a broad-based, in-depth assessment of the second ten-year interval scoping and inspections to confirm compliance with applicable regulatory and ASME Code requirements. During the self-assessment, two issues were identified and were entered into the Corrective Action Program. In addition, four recommendations were made and documented in the assessment, and actions for these were completed. The self-assessment concluded that the Fermi 2 second interval ISI-NDE plan was comprehensive, functional, well maintained and met the objective of complying with ASME Section XI.

- During performance of UT thickness exams of the diesel generator service water (DGSW) piping in 2010, several areas were detected below the bounding criteria. Nineteen sections of DGSW piping were examined by UT. Seventeen of the nineteen sections were found to have significant pitting. This condition was entered into the Corrective Action Program for further evaluation, which resulted in engineering evaluations to determine which sections were acceptable and which sections of piping warranted replacement. Some sections of piping were replaced.

- In December 2011, a self-assessment of the ISI Program was performed. During the self-assessment, there were no findings and only one recommendation for a program enhancement.

As discussed in element 10 to NUREG-1801, Section XI.M1, this program considers the technical information and industry operating experience provided in NRC IN 97-19, IN 84-18, IN 80-38, IN 94-63, IN 91-05, NRC Inspection Report 50-255/99012, IN 97-19, IN 98-11, IN 97-46, NRC Bulletin 88-08, IN 2001-05, IN 2003-11, IN 2004-11, IN 2006-27, and IN 2005-02.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Inservice Inspection Program will remain effective. The continued application of proven inspection methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Inservice Inspection Program has been effective at managing aging effects of loss of material, cracking, and reduction in fracture toughness for ASME Class 1, 2, and 3 pressure-retaining components. The Inservice Inspection Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.22 INSERVICE INSPECTION – IWF

Program Description

The Inservice Inspection (ISI) – IWF Program performs periodic visual examinations of ASME Class 1, 2, 3 and MC piping and component supports to determine general mechanical and structural condition or degradation of component supports, such as verification of clearances, settings, physical displacements, loose or missing parts, debris, corrosion, wear, erosion, or the loss of integrity at welded or bolted connections. The ISI-IWF Program is implemented through plant procedures which provide administrative controls, including corrective actions, for the conduct of activities that are necessary to fulfill the requirements of ASME Section XI, as mandated by 10 CFR 50.55a. The monitoring methods are effective in detecting the applicable aging effects, and the frequency of monitoring is adequate to prevent significant degradation.

The program is currently on its third ten-year ISI inspection interval. The program was developed in accordance with ASME Section XI, 2001 Edition through the 2003 Addenda as approved by 10 CFR 50.55a. In accordance with 10 CFR 50.55a(g)(4)(ii), the Fermi 2 ISI program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified twelve months before the start of the inspection interval.

The ISI-IWF Program scope of inspection for component supports is based on a sampling of piping supports and 100 percent of component supports other than piping as specified in Table IWF-2500-1. The sample size varies depending on the ASME Code classification of the piping.

The selection of component supports subject to examination is based upon Table IWF-2500-1, Examination Category F-A. The number of piping supports selected for inspection is based on a sample size that considers ASME classification. The largest sample size is specified for ASME Class 1 piping supports (25 percent) and decreases for less critical supports (15 percent for ASME Class 2, and 10 percent of ASME Class 3). For component supports other than Class 1, 2, 3 and MC piping supports, a sampling process is not used; rather, 100 percent of these supports is examined each ISI inspection interval. For multiple components other than piping, within a system of similar design, function, and service, the supports of only one of the multiple components are required to be examined.

Discovery of support deficiencies during regularly scheduled inspections are entered in the Corrective Action Program. If the deficiencies exceed acceptance standards of IWF-3400, the scope of inspection is expanded to include additional supports in order to ensure the full extent of the deficiencies is identified. The method of inspection is by visual examination in accordance with IWF-2500 requirements.

Visual examinations are conducted to determine the general mechanical and structural condition or degradation of component supports, such as verification of clearances, settings, physical displacements, loose or missing parts, debris, corrosion, wear, erosion, or the loss of integrity at welded or bolted connections.

Plant procedures will be enhanced to ensure that the selection of bolting material, installation torque or tension, and the use of lubricants and sealants are appropriate for the intended purpose. These procedures include the guidance of EPRI TR-104213, NUREG-1339, and EPRI NP-5769 to ensure proper specification of bolting material, lubricant, and installation torque. Plant procedures prohibit the use of lubricants containing molybdenum disulfide. Since the use of this type of lubricant is prohibited in plant procedures and plant procedures provide the technical guidance for installation requirements (lubricants or compounds used in threaded joints shall be suitable for the service conditions and shall not react unfavorably with the joint materials), the potential for stress corrosion cracking for high-strength structural bolting material, i.e., ASTM A325 and A490, is not plausible.

The ISI-IWF Program implementing procedures specify acceptance criteria and corrective actions. Supports that require corrective actions are re-examined during the next inspection period consistent with IWF-2420.

NUREG-1801 Consistency

The Inservice Inspection – IWF Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S3, ASME Section XI, Subsection IWF.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
2. Preventive Actions	Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting.

Element Affected	Enhancement
2. Preventive Actions (cont.)	Revise plant procedures to require structural bolting replacement and maintenance activities to include appropriate preload and proper tightening (torque or tension) as recommended in EPRI documents, ASTM standards, and American Institute of Steel Construction (AISC) Specifications, as applicable. Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
4. Detection of Aging Effects	Revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts and/or bolts, and cracking of concrete around the anchor bolts.
6. Acceptance Criteria	Revise plant procedures to identify the following unacceptable conditions: • Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support. • Cracked or sheared bolts, including high-strength bolts, and anchors.

<u>Operating Experience</u>

The following examples of operating experience provide objective evidence that the ISI-IWF program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

- During a planned assessment in 2008, Fermi discovered that when applying the Code Case N-491-1 selection criteria for the second interval, the evaluation did not adequately address supports other than piping supports. This issue was entered into Fermi's Corrective Action Program. Fermi performed a complete review of plant equipment that could be considered component supports other than piping supports as described in ASME Code Case N-491-1. Additional supports were added to the ISI program.

- After periodic inspections in 2009, there were no discrepancies in as-found inspections of Division 1, Division 2 and non-Division component anchors and component supports.

- In 2010, 34 supports were inspected in accordance with the NDE program. Inspection of one pipe support identified a discrepancy in the gap between the pipe and the pipe support box. The issue was entered into the Corrective Action Program, and the issue was resolved.
- In 2012, 40 supports were inspected. Only one corrective action report was written on rust/water at one of four torus earthquake ties. Nineteen main steam constant support hangers were also inspected in the steam tunnel. Although wear was observed, all supports were found acceptable based on evaluation. A minor repair was performed on one support.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide reasonable assurance that the ISI-IWF Program will remain effective. The continued application of these proven inspection methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Inservice Inspection – IWF Program has been effective at identifying and managing the aging effects of loss of material of ASME Class 1, 2, 3 and MC component supports. The ISI-IWF Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.23 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS

Program Description

Cranes and hoists in the scope of license renewal are monitored in accordance with the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (OVHLL Program). Inspection activities are implemented through plant procedures. The existing activities consist of periodic inspections and preventive maintenance that are relied upon to manage loss of material due to corrosion, loose bolting or rivets, and crane rail wear of cranes and hoists in the scope of 10 CFR 54.4. The activities rely on visual examinations and functional testing to ensure that cranes and hoists are capable of sustaining their rated loads, thus ensuring their intended function is maintained during the period of extended operation. The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes and hoists. The functional test examinations are performed on active components of the crane to ensure proper functionality and are not credited for managing aging of passive components of cranes and hoists.

The scope of the program includes structural components, including structural bolting, that make up the bridge, the trolley, lifting devices, and rails in the rail system and includes cranes and hoists that meet the provisions of 10 CFR 54.4(a)(1) and (a)(2) as well as NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants."

The aging management activities specified in this program will be enhanced to utilize the guidance provided in ASME Safety Standard B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)."

NUREG-1801 Consistency

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M23, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program 3. Parameter Monitored or Inspected	Revise plant procedures to specify the monitoring of rails in the rail system for loss of material due to wear; monitor structural components of the bridge, trolley and hoists for deformation, cracking, and loss of material due to corrosion; and monitor structural connections/bolting for loose or missing bolts, nuts, pins or rivets and any other conditions indicative of loss of bolting integrity.
4. Detection of Aging Effects	Revise plant procedures to specify inspection frequency requirements will be in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series.
6. Acceptance Criteria	Revise plant procedures to require that significant loss of material due to wear of rails in the rail system and any sign of loss of bolting integrity will be evaluated in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. Revise plant procedures to specify that maintenance and repair activities will utilize the guidance provided in ASME B30.2 or other appropriate standard in the ASME B30 series.

Operating Experience

The following examples of operating experience provide objective evidence that the OVHLL Program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis during the period of extended operation:

- In 2005, following the April 24, 2004, DTE Electric Monroe Power Plant hoist failure, a review of Fermi 2 cranes and hoists was conducted. During this review, it was found that more information was needed in site maintenance procedures to address inspection provisions of codes and standards and vendor manuals. As a result of this review, site procedures were enhanced to incorporate additional inspections.
- In 2009, the NRC performed a crane and heavy lift inspection as part of an operating experience smart sample program. The guidance for the inspection is in supplemental guidance to inspection procedure 71111.20. The inspection was performed and no issues were found.

The results of program inspections and the results of program reviews and assessments against industry operating experience demonstrate that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program has been effective. The continued application of proven visual inspection methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program has been effective at identifying and managing the aging effect of loss of material of crane rails and structural steel components of cranes. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.24 INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS

Program Description

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program that will manage fouling, cracking, loss of material, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of piping and components in environments other than open-cycle cooling water, closed treated water, and fire water. Program periodic surveillances or maintenance activities will be conducted when the surfaces are accessible for visual inspection.

Where practical, the inspections will focus on the bounding or lead components most susceptible to aging because of time in service and severity of operating conditions. At a minimum, in each 10-year period during the period of extended operation, a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population will be inspected. Opportunistic inspections will continue in each period despite meeting the sampling limit.

For metallic components, visual inspection of surface conditions will be used to detect evidence of loss of material and fouling. For non-metallic components, visual inspections and physical manipulation or pressurization will be used to detect evidence of surface discontinuities such as cracking and change in material properties. Visual examinations of elastomeric components will be accompanied by physical manipulation such that changes in material properties are readily observable. The sample size for physical manipulation will be at least ten percent of accessible surface area, including visually identified suspect areas.

Specific acceptance criteria will be as follows:

- Stainless steel: clean surfaces, shiny, no abnormal surface condition.
- Metals: no abnormal surface condition.
- Elastomerics: no change in material properties.
- Rigid polymers: no surface changes affecting performance such as erosion and cracking.

Conditions that do not meet the acceptance criteria will be entered into the Corrective Action Program for evaluation. Any indications of relevant degradation will be evaluated using design standards, procedural requirements, current licensing basis, and industry codes or standards.

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

NUREG-1801 Consistency

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be consistent with the program described in NUREG-1801, Section XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation."

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program. Industry operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

The Fermi 2 program is based on the program description in NUREG-1801 Section XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, which in turn is based on industry operating experience that demonstrates that this program is effective for managing the aging effects described herein.

As discussed in element 10 to NUREG-1801, Section XI.M38, inspections of internal surfaces during the performance of periodic surveillance and maintenance activities have been in effect at many utilities in support of plant component reliability programs. These activities have proven effective in maintaining the material condition of plant systems, structures, and components. The elements that comprise these inspections (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice and staff expectations.

As such, operating experience assures that implementation of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage the effects of aging such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be effective for managing aging effects of fouling, cracking of elastomers, loss of material, and change in material properties since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Internal Surfaces in Miscellaneous Piping and Ducting Components Program will provide reasonable assurance that effects of aging for metallic and non-metallic components will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.25 MASONRY WALL

Program Description

The Masonry Wall Program is implemented as part of the Structures Monitoring Program (Section B.1.42). The Masonry Wall Program is based on guidance provided in IE Bulletin 80-11, "Masonry Wall Design," and IN 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11." The scope of the Masonry Wall Program includes masonry walls within the scope of license renewal as delineated in 10 CFR 54.4. The program manages loss of material and cracking of masonry walls so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.

The program includes visual inspections of masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are masonry walls required by 10 CFR 50.48, radiation-shielding masonry walls, and masonry walls with the potential to affect safety-related components. Aging management of structural steel components, steel edge supports, and steel bracing of masonry walls are addressed by the Structures Monitoring Program (Section B.1.42).

Masonry walls are visually examined at a frequency to ensure there is no loss of intended function between inspections.

NUREG-1801 Consistency

The Masonry Wall Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S5, Masonry Walls Program.

Exceptions to NUREG-1801

None

Enhancements

Enhancements to this program are included in the enhancements to the Structures Monitoring Program (Section B.1.42).

Operating Experience

The following example of operating experience provides objective evidence that the Masonry Wall program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

- In 2007, during maintenance rule structural walkdowns, loose grout in a block wall in the turbine building basement was found. This condition was entered into Fermi's Corrective Action Program and the grout was repaired.

The history of identification of degradation and initiation of corrective action prior to loss of intended function provides reasonable assurance that the Masonry Wall Program will remain effective. The continued application of these proven inspection methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Masonry Wall Program has been effective at identifying and managing the aging effects of loss of material and cracking of concrete block wall components. The Masonry Wall Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

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. 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.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E4, Metal Enclosed Bus.

NUREG-1801 Consistency

The Metal Enclosed Bus Inspection Program will be consistent with the program described in NUREG-1801, Section XI.E4, Metal-Enclosed Bus.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Metal Enclosed Bus Inspection Program is a new program. Industry and plant operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is implemented and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

There is no operating experience at Fermi 2 involving the aging effects managed by this program. However, the elements of the program inspections (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice and have been used effectively at Fermi 2 in other programs. Accordingly, there is reasonable assurance that this new aging management program will be effective during the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Metal Enclosed Bus Inspection Program will be effective for managing the aging effects of increased connection resistance, change in material properties, loss of material, and reduced insulation resistance since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Metal Enclosed Bus Inspection Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.27 NEUTRON-ABSORBING MATERIAL MONITORING

Program Description

The Neutron-Absorbing Material Monitoring Program provides reasonable assurance that degradation of the neutron-absorbing material (Boral) used in spent fuel pools that could compromise the criticality analysis will be detected. The program relies on periodic inspection, testing, and other monitoring activities to assure that the required five percent sub-criticality margin is maintained during the period of extended operation. The program monitors loss of material and changes in dimension such as blisters, pits, and bulges that could result in a loss of neutron-absorbing capability. The parameters monitored include physical measurements and geometric changes in test coupons. The frequency of testing will be based on the condition of the neutron-absorbing material, justified with plant-specific operating experience, prior to the period of extended operation, at a minimum of once every ten years in the period of extended operation. The approach to relating measurement results of the coupons to the spent fuel neutron-absorber materials considers the spent fuel loading strategy. In the event that a loss of neutron-absorbing capacity is anticipated based on coupon testing, additional testing will be performed to ensure the sub-criticality requirements are met.

NUREG-1801 Consistency

The Neutron-Absorbing Material Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M40, Monitoring of Neutron-Absorbing Materials Other than Boraflex.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
4. Detection of Aging Effects	Prior to the period of extended operation, revise Neutron-Absorbing Material Monitoring Program procedures to establish an inspection frequency, justified with plant-specific operating experience, of at least once every ten years, based on the condition of the neutron-absorbing material.

Element Affected	Enhancement
5. Monitoring and Trending	Revise Neutron-Absorbing Material Monitoring Program procedures to perform trending of coupon testing results to determine the rate of degradation. Ensure the predicted boron-10 areal density will be sufficient to maintain the subcritical conditions required by technical specifications until the next coupon test.

Operating Experience

The following examples of operating experience demonstrate that the Neutron-Absorbing Material Monitoring Program will be effective in managing the effects of aging on the function of the spent fuel racks containing Boral.

- In 2010, a Boral test coupon was found with numerous blisters (18 on the front side and 16 on the back side). One of the blisters on the front was 2.1 inches in diameter. Blisters can potentially result in fuel assembly binding during insertion or withdrawal from the fuel storage racks. An evaluation determined these blisters did not affect the neutron-absorbing properties of the Boral. The inspection procedure was revised to require a blister characterization if blisters are observed on the Boral coupon and to require an inspection of the Boral capsule for any deformation that would be caused by blisters.

- Based on operating experience presented at an Electric Power Research Institute (EPRI) Neutron Absorber User Group (NAUG) meeting, procedure enhancements were made in 2010 regarding Boral coupon surveillance. Also, an assessment of the blister resistance of the Boral based on testing of a coupon was performed.

- A Boral coupon test was performed in 2013 at Pennsylvania State University. Non-destructive examination was performed on coupon YD610122-1-7. The coupon was in good overall condition with several very small blisters. All acceptance criteria were met.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program enhancements, provides assurance that the Neutron-Absorbing Material Monitoring Program will remain effective. The continued application of these proven monitoring methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Neutron-Absorbing Material Monitoring Program has been effective at ensuring that the required five percent sub-criticality margin is maintained. The Neutron-Absorbing Material Monitoring Program provides reasonable assurance that the effects of aging on the neutron-absorbing material (Boral) will be managed to ensure the intended function can be maintained in accordance with the current licensing basis through the period of extended operation.

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, 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.

The inspections will be performed prior to the period of extended operation.

NUREG-1801 Consistency

The Non-EQ Cable Connections Program is consistent with the program described in NUREG-1801, Section XI.E6, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Non-EQ Cable Connections Program is a new program. Industry and plant operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is implemented and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

This inspection program applies to potential aging effects for which there is no operating experience at Fermi 2 indicating the need for an aging management program.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Non-EQ Cable Connections Program will be effective for managing the aging effect of increased resistance of connection since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Cable Connections Program provides assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.29 NON-EQ INACCESSIBLE POWER CABLES (400 V TO 13.8 KV)

Program Description

The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program is a new condition monitoring program that will manage the aging effect of reduced insulation resistance on inaccessible power (400 V to 13.8 kV) cables that have a license renewal intended function. The cables included in this program are routed underground in conduit, duct bank or direct buried.

In-scope power cables (400 V to 13.8 kV) exposed to significant moisture will be tested at least once every six years to provide an indication of the condition of the conductor insulation, with the first tests occurring before the period of extended operation. A proven, commercially available test will be used for detecting deterioration of the insulation.

The program will include periodic inspections for water accumulation in manholes within the scope of this program at least once every year (annually). In addition to the periodic manhole inspections, manhole inspection for water after events such as heavy rain or flooding will be performed. Inspection frequency will be adjusted as necessary based on evaluation of inspection results.

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

NUREG-1801 Consistency

The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program is consistent with the program described in NUREG-1801, Section XI.E3, Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program is a new program. Industry and plant-specific operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is implemented and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

While the Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program is a new program, related actions have been taken in recent years in response to industry and plant-specific operating experience. Actions taken have included repair of some underground cable vaults, installation of some sump pumps, instituting periodic monitoring and pumping of cable vaults, and development of cable monitoring procedures. The cable monitoring procedures were created in response to information in GL 2007-01 and include monitoring of safety-related and generation-significant cables in the power plant and underground raceways. The actions taken have reduced cable exposure to water in underground manholes and raceways.

The response to GL 2007-01 identified one inservice cable failure that falls within the scope of this new Non-EQ Inaccessible Power Cable (400 V to 13.8 kV) Program. The failure was a 480 V normally energized cable that provides backup power to the combustion turbine generator transformer. The cable was in service for approximately 39 years. The probable cause of failure was a degraded conduit or degraded cable insulation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program will be effective for managing the aging effect of reduced insulation resistance (IR) since it will incorporate preventive actions, monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.30 NON-EQ INSTRUMENTATION CIRCUITS TEST REVIEW

Program Description

The Non-EQ Instrumentation Circuits Test Review Program is a new performance monitoring program that will manage the aging effects of applicable cables in the following systems or sub-systems.

- Neutron monitoring
  - Intermediate range channels (IRMs)
  - Average power range monitors (includes local power range monitors [LPRM] detector strings)
- Process radiation monitoring
  - Control center emergency air inlet radiation monitors
  - Fuel pool ventilation exhaust radiation monitors
  - Main steam line radiation monitors

The Non-EQ Instrumentation Circuits Test Review Program will provide reasonable assurance that the intended functions of sensitive, high-voltage, low-level current cables exposed to adverse localized equipment environments caused by heat, radiation and moisture (i.e., neutron monitoring instrumentation and process radiation monitoring) can be maintained consistent with the current licensing basis through the period of extended operation. Most sensitive instrumentation circuit cables and connections are included in the instrumentation loop calibration at the normal calibration frequency, which provides sufficient indication of the need for corrective actions based on acceptance criteria related to instrumentation loop performance. The review of calibration results or findings of surveillance testing programs will be performed once every ten years, with the first review occurring before the period of extended operation.

For sensitive instrumentation circuit cables that are disconnected during instrument calibrations, testing using a proven method for detecting deterioration for the insulation system (such as insulation resistance tests or time domain reflectometry) will occur at least once every ten years, with the first test occurring before the period of extended operation. Applicable industry standards and guidance documents will be used to delineate the program.

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

NUREG-1801 Consistency

The Non-EQ Instrumentation Circuits Test Review Program will be consistent with the program described in NUREG-1801, Section XI.E2, Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Non-EQ Instrumentation Circuits Test Review Program is a new program. Industry operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

As stated in NUREG-1801, Revision 2, Section XI.E2, industry operating experience has identified a case where a change in temperature across a high-range radiation monitor cable in containment resulted in substantial change in the reading of the monitor. Changes in instrument calibration can be caused by degradation of the circuit cable and are a possible indication of electrical cable degradation. The vast majority of industry operating experience regarding neutron flux instrumentation circuits is related to cable/connector issues inside containment near the reactor vessel. Although Fermi 2's operating experience includes instances of neutron monitoring cable or connection failures, a review of plant-specific operating experience identified no aging mechanisms not addressed in NUREG-1801.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Non-EQ Instrumentation Circuits Test Review Program will be effective for managing the aging effect of reduced insulation resistance (IR) since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Instrumentation Circuits Test Review Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.31 NON-EQ INSULATED CABLES AND CONNECTIONS

Program Description

The Non-EQ Insulated Cables and Connections Program is a new condition monitoring program that provides reasonable assurance that intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation[1] and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the plant design environment for the cable or connection insulation materials.

Accessible insulated cables and connections within the scope of license renewal installed in an adverse localized environment will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination. The inspection of accessible cables will represent, with reasonable assurance, all cables and connections in the adverse localized environment.

An adverse localized equipment environment is a plant-specific condition that will be determined based on a plant spaces approach. The plant spaces approach provides for a review of all buildings and rooms in the scope of license renewal to determine potential adverse localized environments. The determination of a potential adverse localized equipment environment will be based on the most limiting temperature, radiation, or moisture conditions for the cables and connection insulation material located at Fermi 2. The evaluation of an adverse localized equipment environment will be based on the most limiting temperature, radiation, or moisture conditions for the cables and connection insulation material located within that plant space that has a potential adverse localized equipment environment.

This program will visually inspect accessible cables in an adverse localized environment at least once every ten years, with the first inspection prior to the period of extended operation.

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

NUREG-1801 Consistency

The Non-EQ Insulated Cables and Connections Program will be consistent with the program described in NUREG-1801, Section XI.E1, Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

Exceptions to NUREG-1801

None

1. Reduced insulation resistance from an environment of radiation and air (oxygen) includes radiolysis, photolysis of organics, or radiation induced oxidation. Photolysis is limited to UV sensitive materials.

Enhancements

None

Operating Experience

The Non-EQ Insulated Cables and Connections Program is a new program. Industry operating experience will be considered in the implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

As stated in NUREG-1801, Revision 2, Section XI.E1, industry operating experience has shown that adverse localized environments caused by heat/radiation/moisture for electrical cables and connections may exist near steam generators, pressurizers, or hot process pipes, such as feedwater lines. In this industry experience, such adverse localized environments have caused degradation of insulating materials on electrical cables and connections that is visually observable, such as color changes or surface cracking. These visual indications can indicate cable degradation. The examination techniques used in this program to detect aging effects are proven industry techniques that have been effectively used at Fermi 2 in other programs.

For example, during an inspection in the limit switch compartment for a feedwater heater inlet isolation valve in 2009, cable heat damage was identified. In 2010, during the work order for replacing the degraded cables identified in 2009, cables were examined in a junction box in the feedwater heater room. Moderate degradation was observed to the cables within the junction box, so new cables were pulled to outside the heater room. The cable degradation was identified during planned inspection. The cable to the valve had not failed to perform its intended function.

Age-related cable brittleness was identified and repaired during RF11 in 2006. Work requests were initiated to replace degraded cables on the turbine valves unitized actuators. Cables were replaced in 2009 and 2012.

Accordingly, there is reasonable assurance that this new aging management program will be effective during the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Non-EQ Insulated Cables and Connections Program will be effective for managing the aging effect of reduced insulation resistance (IR) since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Non-EQ Insulated Cables and Connections Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.32 OIL ANALYSIS

Program Description

The Oil Analysis Program ensures that loss of material and fouling are not occurring by maintaining the quality of the lubricating oil. The program ensures that contaminants (primarily water and particulates) are within acceptable limits. Testing activities include sampling and analysis of lubricating oil for detrimental contaminants. Testing results indicating the presence of water in oil samples initiate corrective action that may include evaluating for in-leakage.

The One-Time Inspection Program utilizes inspections or nondestructive evaluations of representative samples to verify that the Oil Analysis Program has been effective at managing the aging effects.

NUREG-1801 Consistency

The Oil Analysis Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M39, Lubricating Oil Analysis.

Exceptions to NUREG-1801

None

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program	Revise Oil Analysis Program procedures to identify components within the scope of the program.
3. Parameters Monitored or Inspected 4. Detection of Aging Effects 6. Acceptance Criteria	Revise Oil Analysis Program procedures to provide a formalized analysis technique for particulate counting.
4. Detection of Aging Effects	Revise Oil Analysis Program procedures to include the sampling and testing recommendations of equipment manufacturers or industry standards.

Operating Experience

The following examples of operating experience provide objective evidence that the Oil Analysis Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- In 2004, a self-assessment of the lubrication program was performed to review the receipt, qualification, storage, sample data transmission and issuance of lubricants. The self-assessment concluded that the overall health of the lubrication program was good. Thirteen recommendations and four suggestions were entered into the Corrective Action Program for evaluation and resolution. Actions were taken to consolidate lubricants and to improve configuration control.
- In 2004, a routine oil sample taken on a standby liquid control pump gearbox indicated a high severe wear index. Follow-up vibration readings were reported high. The pump was removed from service, and investigation determined there was a low oil level. The gearbox was disassembled for inspection with no abnormalities noted. The gear box was cleaned out, new oil added, and the pump was restored to service.
- In 2007, the RCIC turbine was declared inoperable due to excessive water content in the RCIC turbine oil sample. The excessive water content was caused by leaking valve internals and inadequate draining during preventive maintenance. This condition was not attributed to oil degradation due to aging, but the experience led to an enhancement of the program entailing selection of a better sampling location.

The Oil Analysis Program has been effective at maintaining quality oil at Fermi 2. Negative trends in oil have been adequately documented, and out-of-specification oil has been replaced as necessary.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Oil Analysis Program will remain effective. The continued application of proven sampling methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Oil Analysis Program has been effective at identifying and managing aging effects of loss of material and fouling of component surfaces exposed to lubrication oil. The Oil Analysis Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.33 ONE-TIME INSPECTION

Program Description

The One-Time Inspection Program is a new program utilizing inspections that verify unacceptable degradation is not occurring. These inspections will be performed within the ten years prior to the period of extended operation. This program will consist of a one-time inspection of selected components to accomplish the following:

- Verify the effectiveness of an aging management program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The aging effects evaluated are loss of material, cracking, and fouling.
- Confirm the insignificance of an aging effect for situations in which additional confirmation is appropriate using inspections that verify degradation is not occurring.
- Trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.

The sample size will be 20 percent of the components in each material-environment-aging effect group up to a maximum of 25 components. Identification of inspection locations will be based on the potential for the aging effect to occur. Examination techniques will use established NDE methods with a demonstrated history of effectiveness in detecting the aging effect of concern, including visual, ultrasonic, and surface techniques. Acceptance criteria will be based on applicable ASME or other appropriate standards, design basis information, or vendor-specified requirements and recommendations. Any indication or relevant condition of degradation detected will be evaluated. The need for follow-up examinations will be evaluated based on inspection results.

The One-Time Inspection Program will not be used for structures or components with known age-related degradation mechanisms or if the environment in the period of extended operation is not expected to be equivalent to that in the prior 40 years. In these cases, a periodic plant-specific inspection will be performed.

The following table identifies potential inspection methods for specific aging effects.

Parameters Monitored and Inspection Methods for Specific Aging Effects			
Aging Effect	**Aging Mechanism**	**Parameters Monitored**	**Inspection Methods**
Loss of material	Crevice corrosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Loss of material	Galvanic corrosion	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	General corrosion	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	Microbiologically induced corrosion (MIC)	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	Pitting corrosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Loss of material	Erosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Reduction of heat transfer	Fouling	Surface condition	Visual (VT-3 or equivalent)
Cracking	SCC or cyclic loading	Surface condition	Enhanced visual (EVT-1 or equivalent) or surface examination (magnetic particle, liquid penetrant) or volumetric (radiographic testing or UT)

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

Diesel Fuel Monitoring Program (Section B.1.14)	One-time inspection activity will verify the effectiveness of the Diesel Fuel Monitoring Program by confirming that unacceptable loss of material is not occurring.
Oil Analysis Program (Section B.1.32)	One-time inspection activity will verify the effectiveness of the Oil Analysis Program by confirming that unacceptable loss of material and fouling is not occurring.

Water Chemistry Control – BWR Program (Section B.1.43)	One-time inspection activity will verify the effectiveness of the Water Chemistry Control – BWR Program by confirming that unacceptable cracking, loss of material, and fouling is not occurring.
Stainless steel reactor vessel flange leak-off piping and valve body	One-time inspection activity will confirm that cracking is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of core spray piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of RHR piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of HPCI turbine exhaust piping passing through the waterline region of the suppression pool and HPCI turbine exhaust drain piping to the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of nuclear pressure relief piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of RCIC piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

Inspections will be performed within the ten years prior to the period of extended operation.

NUREG-1801 Consistency

The One-Time Inspection Program will be consistent with the program described in NUREG-1801, Section XI.M32, One-Time Inspection.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The One-Time Inspection Program is a new program. Industry operating experience will be considered in the implementation of this program.

This inspection program applies to potential aging effects for which there is no operating experience at Fermi 2 indicating the need for an aging management program. As stated in NUREG-1801, Revision 2, Section XI.M32, the elements of these inspections (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice and use developed and approved industry techniques for inspection such as UT and visual exams. These techniques have also been proven effective for detection of aging effects outside of this program, as documented in operating experience for other programs such as the Flow-Accelerated Corrosion (Section B.1.20) and Inservice Inspection (Section B.1.21) programs.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The One-Time Inspection Program will be effective at identifying and managing aging effects of loss of material, fouling, and cracking because it incorporates proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The One-Time Inspection Program provides assurance that the Diesel Fuel Monitoring Program, Oil Analysis Program, Water Chemistry Control – BWR Program, and other identified aging management activities will be effective in managing the effects of aging to ensure component intended functions can be maintained in accordance with the current licensing basis through the period of extended operation.

B.1.34 ONE-TIME INSPECTION – SMALL-BORE PIPING

Program Description

The One-Time Inspection – Small-Bore Piping Program is a new program that will augment ASME Code, Section XI (2001 Edition with 2003 Addenda) requirements and is applicable to small-bore ASME Code Class 1 piping and components with a nominal pipe size diameter less than four inches (NPS 4) and greater than or equal to one inch (NPS 1) in systems that have not experienced cracking of ASME Code Class 1 small-bore piping. Fermi 2 has not experienced cracking of ASME Code Class 1 small-bore piping less than NPS 4 and greater than or equal to NPS 1 due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence. The program can also be used for systems that have experienced cracking but have implemented design changes to effectively mitigate cracking.

This program will provide a one-time volumetric or (socket welds only) opportunistic destructive inspection of ASME Class 1 piping butt weld locations and socket weld locations that are susceptible to cracking. Volumetric examinations will be performed using a demonstrated technique that is capable of detecting the aging effect of cracking in the volume of interest. In the event the opportunity arises to perform a destructive examination of an ASME Class 1 small-bore socket weld that meets the susceptibility criteria, then the program will take credit for two volumetric examinations. The program will include pipes, fittings, branch connections, and full and partial penetration welds.

This program will include a sampling approach. Sample selection will be based on susceptibility to stress corrosion, cyclic loading (including thermal, mechanical, and vibration fatigue), thermal stratification and thermal turbulence, and failure history. Since Fermi 2 will not have more than 30 years of operation at the time of submitting the license renewal application, the inspections will include ten percent of the weld population or a maximum of 25 welds of each weld type (e.g., full penetration and socket weld).

The program will include measures to verify that degradation is not occurring, thereby either confirming that there is no need to manage aging-related degradation or validating the effectiveness of any existing program for the period of extended operation. If evidence of cracking is revealed by this one-time inspection, it will be entered into the Corrective Action Program to determine extent of condition, and a follow-up periodic inspection will be managed by a plant-specific program. Flaws or indications will be evaluated in accordance with the ASME Code.

The inspection will be performed within the six-year period prior to the period of extended operation.

NUREG-1801 Consistency

The One-Time Inspection – Small-Bore Piping Program will be consistent with the program described in NUREG-1801, Section XI.M35, One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The One-Time Inspection – Small Bore Piping Program is a new program. Industry operating experience will be considered in the implementation of this program.

Fermi 2 has not experienced cracking of ASME Code Class 1 small-bore piping less than NPS 4 and greater than or equal to NPS 1 due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence.

As stated in NUREG-1801, Revision 2, Section XI.M35, this program uses volumetric inspection techniques with demonstrated capability and a proven industry record to detect cracking in piping weld and base material. Accordingly, there is reasonable assurance that this new aging management program will be effective.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The One-Time Inspection – Small-Bore Piping Program will be effective at identifying and managing the aging effect of cracking in ASME Class 1 small-bore piping because it incorporates proven techniques, acceptance criteria, corrective actions, and administrative controls. The One-Time Inspection – Small-Bore Piping Program will provide reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.35 PERIODIC SURVEILLANCE AND PREVENTIVE MAINTENANCE

Program Description

There is no corresponding NUREG-1801 program.

The Periodic Surveillance and Preventive Maintenance (PSPM) Program manages aging effects not managed by other aging management programs, including loss of material, fouling, loss of material due to wear, and loss of sealing. Any indication or relevant condition of degradation detected is evaluated. Inspections occur at least once every five years during the period of extended operation.

The Fermi 2 aging management review credits the following inspection activities.

Reactor building	Visually inspect and manually flex the rubber gasket/seal for spent fuel storage pool gates to verify no loss of sealing.
Emergency diesel generator system	Visually inspect a representative sample of air coolant, lube oil, and jacket water heat exchanger tubes to manage loss of material due to wear.
Fire water system	Use visual or other NDE techniques to inspect internal surfaces to manage fouling of the heat exchanger tubes exposed to raw water.
Combustion turbine generator system	Visually inspect a representative sample of lube oil heat exchanger tubes to manage loss of material due to wear. Visually inspect a representative sample of atomizing air precooler heat exchanger tubes to manage fouling and loss of material due to wear. Visually inspect and clean atomizing air booster compressor suction filter to manage fouling. Visually inspect and clean compressor extraction air filter to manage fouling.
Containment atmospheric control system	Use visual or other NDE techniques to inspect recombiner system component internal surfaces to manage loss of material.
Nonsafety-related systems affecting safety-related systems	Visually inspect the internal surface of a representative sample of nuclear boiler system (B21) piping and valve bodies to manage loss of material.
	Perform visual or ultrasonic inspection of a representative sample of the internal surface of fuel pool cooling and cleanup system (G41) abandoned piping to manage loss of material.

Nonsafety-related systems affecting safety-related systems (cont.)	Visually inspect the internal surface of a representative sample of condensate system (N20) piping, pump casing, tanks, and valve bodies to manage loss of material.
	Visually inspect the internal surface of a representative sample of heater drains system (N22) piping, thermowells, and valve bodies to manage loss of material.
	Visually inspect the internal surface of a representative sample of main turbine generator and auxiliaries system (N30) piping, tanks, and valve bodies to manage loss of material.
	Visually inspect the internal surface of a representative sample of condenser and auxiliaries system (N61) piping and valve bodies to manage loss of material.
	Visually inspect the internal surface of process sampling system (P33) chiller and cooler housing to manage loss of material.
	Visually inspect the internal surface of a representative sample of drips, drains and vents system (P95) piping and valve bodies to manage loss of material.
	Visually inspect the internal surface of a representative sample of reactor/auxiliary building HVAC system (T41) piping, strainer housing, tubing, and valve bodies to manage loss of material.
	Visually inspect the internal surface of a representative sample of containment atmospheric control system (T48) piping and valve bodies to manage loss of material.

Evaluation

1. Scope of Program

The PSPM Program, with regard to license renewal, includes the specific structures and components identified in the aging management reviews as listed in the table above.

2. Preventive Actions

Similar to other condition monitoring programs described in NUREG-1801, the PSPM Program does not include preventive actions.

3. Parameters Monitored/Inspected

The PSPM Program monitors and inspects surface condition to identify degradation of the particular structure or component. This program monitors for degradation by

(a) inspecting surface condition and flexibility for elastomeric components and (b) inspecting the surface condition of internal and external surfaces of metallic components.

4. Detection of Aging Effects

Periodic surveillances and preventive maintenance activities provide for component inspections to detect aging effects. Inspection intervals are established such that they provide timely detection of degradation prior to loss of intended functions. Inspection intervals, sample sizes, and data collection methods are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

Each inspection occurs at least once every five years. The selection of components to be inspected will focus on locations which are most susceptible to aging, where practical. Established inspection methods to detect aging effects of loss of material, loss of material due to wear, and fouling include visual inspections for metallic and glass-like components. Inspection of elastomeric materials to detect loss of sealing includes visual inspections for conditions such as flexibility by manually flexing the component. Inspections are performed by personnel qualified to perform the inspections.

For each activity that refers to a representative sample, a representative sample is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components.

5. Monitoring and Trending

Periodic surveillance and preventive maintenance activities provide for monitoring and trending of aging degradation. Inspection intervals are established such that they provide for timely detection of component degradation.

6. Acceptance Criteria

PSPM Program acceptance criteria are defined in specific inspection procedures. The acceptance criterion is no indication of relevant degradation. For example, if the specific inspection is monitoring the surface condition for corrosion, wear, flaking, etc., then the acceptance criterion is the absence of corrosion, wear, flaking, etc.

7. Corrective Actions

Unacceptable conditions are evaluated. Corrective actions, including root cause determination and prevention of recurrence, are implemented as discussed in Section B.0.3.

8. Confirmation Process

This element is discussed in Section B.0.3.

9. Administrative Controls

This element is discussed in Section B.0.3.

10. Operating Experience

The following examples of operating experience provide objective evidence that the PSPM Program will be effective in managing the effects of aging by identifying problems, initiating corrective action and implementing program improvements.

- A major upgrade of the PSPM program was performed to reclassify component criticality. Starting in 2009, Fermi 2 reclassified previously classified critical components by applying industry standard definitions of component criticality. The result was a reduction in the number of components classified critical. The number of critical components is now in line with industry benchmarking for a single unit BWR. The reclassification had an immediate benefit in an increased respect for preventive maintenance activities on critical components and more economic maintenance strategies on the remaining components. While the new aging management activities will increase the number of PM activities, the increase is not significant.

- Following an INPO assessment in 2011, Fermi created plant-specific templates for selected PM activities, validated PM classifications, instituted a risk-based approach for first time PMs, and adopted a living PM program philosophy. Implementation of the templates into individual maintenance strategies is ongoing. In 2013, a self-assessment looked at new templates and implementation of maintenance strategies for the new templates. One corrective action was initiated to modify a template, and several improvement items were identified. The template was modified.

The following are recent examples of activities that demonstrate effectiveness of the PSPM Program.

- The PSPM Program is credited to manage loss of material due to wear of heat exchanger tubes in the emergency diesel generator (EDG) system. The air coolant heat exchanger, lube oil heat exchanger, and jacket cooling heat exchanger for EDG 12 were inspected and cleaned in July 2013. Visual inspection, eddy current testing and ultrasonic thickness testing were performed. In the air coolant and lube oil heat exchangers, though some pitting was observed, no tubes met the plugging criteria. Two tubes exceeded the plugging criteria in the jacket cooling heat exchanger and were plugged.

- For the last six years, the as-found condition for CTG 11-1 during the semi-annual and annual PMs has been rated as component condition satisfactory or measured parameter within tolerance but minor adjustment required.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the PSPM Program will remain effective. The continued application of proven monitoring methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program	Revise the PSPM Program procedures as necessary to incorporate the identified activities.
6. Acceptance Criteria	Revise the PSPM Program procedures to state that the acceptance criterion is no indication of relevant degradation and to incorporate the following: • Examples of acceptance criteria for metallic components: - No excessive corrosion (loss of material). - No leakage from or onto internal surfaces (loss of material). - No excessive wear (loss of material). • Examples of acceptance criteria for elastomeric components: - Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color.

Conclusion

The PSPM Program has been effective at identifying and managing aging effects of loss of material, fouling, loss of material – wear, and loss of sealing, since it consists of proven industry standard monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The PSPM Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.36 PROTECTIVE COATING MONITORING AND MAINTENANCE

Program Description

The Protective Coating Monitoring and Maintenance Program monitors and maintains Service Level I coatings applied to carbon steel and concrete surfaces inside containment (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors). The program addresses accessible coated surfaces inside containment. The Fermi 2 program will be enhanced to meet the technical basis of ASTM D5163-08. With these enhancements, the program provides an effective method to assess coating condition through visual inspections by identifying degraded or damaged coatings and providing a means for repair of identified problem areas.

Service Level I protective coatings are not credited to manage the effects of aging. Proper monitoring and maintenance of protective coatings inside containment ensures operability of post-accident safety systems that rely on water recycled through the containment. The proper monitoring and maintenance of Service Level I coatings ensures there is no coating degradation that would impact safety functions, for example, by clogging emergency core cooling systems suction strainers and possibly causing unacceptable head loss in the system.

NUREG-1801 Consistency

The Protective Coating Monitoring and Maintenance Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S8, Protective Coating Monitoring and Maintenance Program.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program	Revise plant procedures to include in the program Service Level I coating applied to steel and concrete surfaces of the steel containment vessel (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors).

Element Affected	Enhancement
3. Parameters Monitored or Inspected	Revise plant procedures to include information and instructions for monitoring Service Level I coating systems to be used for the inspection of coatings in accordance with guidelines identified in ASTM D5163-08. Revise plant procedures to specify the parameters monitored or inspected in accordance with subparagraph 10.2 of ASTM D5163-08.
4. Detection of Aging Effects	Revise plant procedures to establish the inspection frequency in accordance with paragraph 6 of ASTM D5163-08. Revise plant procedures to develop an inspection plan and specify inspection methods to be used in accordance with subparagraph 10.1 of ASTM D5163-08. Revise plant procedures to specify that the nuclear coating specialist qualification recommendations and duties be as defined in ASTM D7108. As a minimum, qualification of inspection personnel (protective coating surveillance personnel) who perform these inspections shall be as specified in ASTM D4537. Revise plant procedures to specify a protective coatings program owner (inspection coordinator and inspection results evaluator) or equivalent to nuclear coating specialist defined in ASTM D5163-08, is responsible for the overall plant coatings program and has general duties and responsibilities similar to those defined for a nuclear coating specialist in Section 5 of ASTM D7108-05. Revise plant procedures to specify that detection of aging effects will include visual inspections of coatings near sumps or screens associated with the emergency core cooling system (ECCS). Revise plant procedures to specify instruments and equipment needed for inspection as identified in subparagraph 10.5 of ASTM D5163-08.

Element Affected	Enhancement
5. Monitoring and Trending	Revise plant procedures to specify that upon the completion of a planned refuel outage, a coatings outage summary report will be prepared of the coating work performed in Service Level I areas during the outage. The summary report prioritizes repair areas as areas that must be repaired during the same outage or postponed to future outages, keeping the coatings under surveillance during the interim period. Revise plant procedures to specify that the last two performance monitoring reports pertaining to the coating systems will be reviewed prior to the inspection or monitoring process.
6. Acceptance Criteria	Revise plant procedures to describe the characterization, documentation, and testing of defective or deficient coating surface in accordance with subparagraphs 10.2.1 through 10.2.6, 10.3, and 10.4 of ASTM D5163-08. Revise plant procedures to specify that the coatings outage summary report will be evaluated and approved by the protective coatings program owner.

Operating Experience

Operating experience has been obtained in monitoring the performance of the primary containment pressure boundary coatings under ASME Section XI-IWE.

- In 2003, degraded coatings were identified during ASME CII-IWE primary containment inspections. Several of the areas required simple recoating, and some of the areas required cleaning of rust and recoating. In none of the cases had the primary containment boundary been degraded.
- In 2005, degraded coatings were identified during CII-IWE inspections of the torus shell coating. All areas identified involved the loss to the torus's protective coating. The inspection results did not identify any degraded areas of the torus shell material. The degraded areas that were identified did not impact the overall operability of the primary containment function of the torus. These repeated failures of torus coatings were attributed to inadequate curing of the initial coating. As a result, the CII-IWE program was modified to require divers to inspect the torus coatings every other outage.
- Torus coating and areas of coating blistering continue to be monitored during inspections and repaired as necessary. During 2012, broken blisters, mechanical damage and pinpoint rust areas were repaired in the wetted areas of the torus. In the vapor region, all

flaking paint was removed from the torus ring header, torus vacuum breaker valves, nitrogen supply lines, monorail rail, and torus walkway and handrail. Flaking or cracked coating on the torus shell was removed and protective coating was re-applied to the torus shell. The total collective surface area of underwater coating repairs performed is estimated at 607 square inches (4.4 square feet).

The history of identification of degradation and initiation of corrective action prior to loss of intended function provides reasonable assurance that the Protective Coating Monitoring and Maintenance Program will remain effective. The application of these proven methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Protective Coating Monitoring and Maintenance Program has been effective at identifying and managing the aging effect of loss of coating integrity on the primary containment pressure boundary. The Protective Coating Monitoring and Maintenance Program, with enhancements, provides reasonable assurance that the effects of aging on coating will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.37 REACTOR HEAD CLOSURE STUDS

Program Description

The Reactor Head Closure Studs Program manages cracking due to SCC or IGSCC and loss of material due to wear or corrosion for reactor head closure stud bolting (studs, washers, nuts, bushings, and threads in flange) using inservice inspection (ASME Section XI, 2001 Edition, 2003 Addendum, Table IWB-2500-1) and preventive measures to mitigate cracking. The program follows examination and inspection requirements to detect and size cracks and detect loss of material. Acceptance criteria and evaluation of indications are in accordance with ASME Section XI and other requirements specified per 10 CFR 50.55a with NRC-approved alternatives.

Preventive actions include avoiding the use of metal-plated stud bolting, use of an acceptable surface treatment, use of stable lubricants, and use of bolting materials with low susceptibility to SCC. The program uses visual, surface, and volumetric examinations as required by ASME Section XI. The program also relies on recommendations to address reactor head closure studs degradation listed in NUREG-1339 and NRC Regulatory Guide (RG) 1.65.

NUREG-1801 Consistency

The Reactor Head Closure Studs Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M3, Reactor Head Closure Stud Bolting, with one exception.

Exceptions to NUREG-1801

The Reactor Head Closure Studs Program is consistent with the program described in NUREG-1801, Section XI.M3, Reactor Head Closure Stud Bolting, with the following exception.

Element Affected	Exception
2. Preventive Actions 7. Corrective Actions	NUREG-1801 recommends use of bolting material for closure studs that has an actual measured yield strength less than 1,034 megapascals (MPa) (150 kilo-pounds per square inch [ksi]). Fermi 2 cannot verify actual measured yield strength of bolting material for closure studs.[1]

Exception Note

1. This is justified based on the following. The criterion of actual yield strength less than 150 ksi was recommended in Section 3 of NUREG-1339 to be used as the level for consideration of vulnerability to SCC. The reactor vessel studs, nuts, closure washers, and threaded bushings at Fermi 2 are fabricated from SA-540 Grade B23 and B24 carbon steel. RG 1.65, October 1973, identifies that SA-540 Grades B23 and B24, when tempered to a maximum tensile strength of 170 ksi, are relatively immune to SCC. Nevertheless, since the actual yield strength is not known, the aging management review conservatively identified the stud material as susceptible to cracking.

Closure studs are cleaned and inspected prior to reassembly. The closure studs are periodically volumetrically (UT) examined per ASME Code, Section XI, Table IWB-2500-1, Category B-G-1, which is appropriate for identifying cracking. There have been no recordable indications identified by ISI Program examination of reactor head closure studs, indicating that the current program has been effective in managing cracking.

Preventive measures listed in NUREG-1801 Section XI.M3, "Reactor Head Closure Stud Bolting," that can reduce the potential for cracking are met by the Fermi 2 Reactor Head Closure Studs Program. These include (1) metal-plated studs are not used, which could cause degradation due to corrosion or hydrogen embrittlement; and (2) an approved stable lubricant is applied to the studs whenever the reactor head is reinstalled. The lubricant used does not contain molybdenum disulfide (MoS_2), which has been shown to be a potential contributor to SCC. An additional preventive measure that will be implemented is to revise the purchasing requirements for reactor head closure stud material to assure that any studs procured in the future will have measured yield strength of less than 150 ksi. Therefore, the Reactor Head Closure Studs Program will be effective in managing cracking during the period of extended operation.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
2. Preventive Actions 7. Corrective Actions	Revise Reactor Head Closure Studs Program procedures to ensure that replacement studs are fabricated from bolting material with actual measured yield strength less than 150 ksi.
2. Preventive Actions	Revise Reactor Head Closure Studs Program procedures to include a statement that excludes the use of MoS_2 on the reactor vessel closure studs and also refers to recommendations in RG 1.65, Rev. 1.

Operating Experience

The following examples of operating experience provide objective evidence that the Reactor Head Closure Studs Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- In 2006, one-third of the reactor vessel closure studs were examined per the ISI-NDE plan in accordance with the applicable ASME Code, Section XI examination requirements. No recordable indications were identified. Surface examinations were performed in accordance with ASME Section III, NB-2545. No indications of cracking or loss of material were found.

- In 2010, inspections were conducted and no indications of cracking or loss of material were found.

As discussed in element 10 to NUREG-1801, Section XI.M3, this program considers the technical information and industry operating experience provided in NRC IE Bulletin 82-02 and NRC GL 91-17.

Inspections on the reactor vessel closure studs are performed in accordance with program requirements. There has been no history of degradation when inspections are performed. Although there have been no deficiencies noted in the past ten years of inspection activity for this program, the history of identification of degradation and initiation of corrective action prior to loss of intended function for other ISI-NDE programs, along with identification of program deficiencies and subsequent corrective actions, provide reasonable assurance that the Reactor Head Closure Studs Program will remain effective. The continued application of proven inspection methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Reactor Head Closure Studs Program has been effective at identifying and managing aging effects of cracking and loss of material of reactor closure stud assemblies. The Reactor Head Closure Studs Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.38 REACTOR VESSEL SURVEILLANCE

Program Description

The Reactor Vessel Surveillance Program manages reduction of fracture toughness of reactor vessel beltline materials due to neutron irradiation embrittlement and monitors reactor vessel long-term operating conditions that could affect neutron irradiation embrittlement of the reactor vessel using material data and dosimetry. The program includes all reactor vessel beltline materials as defined by 10 CFR 50 Appendix G, Section II.F, and complies with 10 CFR 50, Appendix H for vessel material surveillance.

The objective of the reactor vessel material surveillance program is to provide sufficient material data and dosimetry to (a) monitor irradiation embrittlement at the end of the period of extended operation and (b) determine the need for operating restrictions on the inlet temperature, neutron spectrum, and neutron flux.

The original Fermi 2 reactor vessel surveillance program was designed to monitor reactor vessel beltline materials by testing surveillance capsules withdrawn from the Fermi 2 reactor vessel.

The Fermi 2 reactor vessel surveillance program has been integrated into the BWRVIP Integrated Surveillance Program (ISP). The surveillance sample materials remaining in the Fermi 2 reactor pressure vessel (RPV) are maintained as spares for possible future use. The BWRVIP ISP replaces individual plant reactor pressure vessel surveillance capsule programs with representative weld and base materials data from host reactors. Throughout the term of the ISP, the BWRVIP monitors the progress, coordinates future actions such as withdrawal and testing of future capsules and reporting of surveillance capsule test results, and identifies additional program needs. The BWRVIP will identify and implement changes to the program as the need arises. When specific changes are identified to the ISP testing matrix, withdrawal schedule, or testing and reporting of individual capsule results, these modifications will be submitted to the NRC in a timely manner so that appropriate arrangements can be made for implementation.

The integrated surveillance program for the extended period of operation (ISP(E)), based on BWRVIP document BWRVIP-86, Revision 1, has been approved for use by the NRC. BWRVIP-135 provides reactor pressure vessel surveillance data and other technical material information for the plants participating in the ISP and is revised periodically as additional surveillance data is obtained.

NUREG-1801 Consistency

The Reactor Vessel Surveillance Program, with enhancement, is consistent with the program described in NUREG-1801, Section XI.M31, Reactor Vessel Surveillance, with one exception.

Exceptions to NUREG-1801

The Reactor Vessel Surveillance Program (with enhancement) is consistent with the program described in NUREG-1801, Section XI.M31, with the following exception.

Element Affected	Exception
4. Detection of Aging Effects	NUREG-1801 recommends that the reactor vessel surveillance program shall have at least one capsule with projected neutron fluence equal to or exceeding the 60-year peak reactor vessel wall neutron fluence prior to the end of the period of extended operation. A capsule meeting this qualification is not expected to be obtained prior to the end of the period of extended operation.[1]

Exception Note

1. In a letter dated February 10, 2003, Fermi 2 was issued License Amendment No. 152 approving participation in the BWRVIP. In a Safety Evaluation Report (SER) (TAC No. ME2190) dated October 20, 2011, the staff approved BWRVIP-86, Revision 1, "Updated BWR Integrated Surveillance Program (ISP) Implementation Plan." The NRC staff concluded that the ISP and ISP(E) continue to adequately address the requirements of Appendix H to 10 CFR 50 for BWR licensees through the end of each facility's proposed 60-year operating license. BWRVIP-86, Revision 1, Section 5, includes provisions to apply the embrittlement evaluation described in RG 1.99, Revision 2, for evaluating materials and calculating an adjusted reference temperature. The use of RG 1.99, Revision 2 to project the embrittlement evaluation is also described in Element 5 of NUREG-1801 XI.M31. This exception is justified because the provisions set forth in RG 1.99, Revision 2, are acceptable for embrittlement evaluation.

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Element Affected	Enhancement
5. Monitoring and Trending	Revise Reactor Vessel Surveillance Program procedures to ensure that new fluence projections through the period of extended operation and the latest vessel beltline adjusted reference temperature (ART) tables are provided to the BWRVIP prior to the period of extended operation.

Operating Experience

The following example of operating experience provides objective evidence that the Reactor Vessel Surveillance Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- The surveillance capsules in the reactor vessel contain material samples from vessel plate and vessel welds. Fermi 2 is participating in the BWRVIP Integrated Surveillance Program (ISP). The best candidate surveillance capsule with baseline data available was chosen under the BWRVIP. Results of the material analysis were utilized in the preparation of the pressure/temperature curves for Fermi 2.

Appropriate guidance for reevaluation is provided when updated information is provided from the BWRVIP ISP. Therefore, there is confidence that continued implementation of the Reactor Vessel Surveillance Program will effectively manage reduction of fracture toughness of reactor vessel beltline materials due to neutron irradiation embrittlement. The continued participation in the BWRVIP ISP provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4

Conclusion

The Reactor Vessel Surveillance Program has been effective at managing the aging effect of reduction of fracture toughness of reactor vessel materials. The Reactor Vessel Surveillance Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

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

Program Description

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

The program provides guidance on engineering data compilation, inspection activities, technical evaluation, inspection frequency, and the content of inspection reports. Inspections of water-control structures are conducted by or under the direction of qualified engineers experienced in the investigation, design, construction, and operation of the structures. Inspections are conducted systematically using checklists and other documents as required to minimize the possibility of overlooking significant features. Technical evaluations are performed if observed degradations have the potential for impacting the intended function of the water-control structures.

NUREG-1801 Consistency

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S7, RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants.

Exceptions to NUREG-1801

None

Enhancements

Enhancements to this program are included in the enhancements to the Structures Monitoring Program (Section B.1.42).

Operating Experience

The following examples of operating experience provide objective evidence that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- The general service water pump house and residual heat removal complex have been inspected every fourth refueling outage under the Structures Monitoring Program. The last inspections occurred during the December 2007 to January 2008 time frame. There were no significant findings during this inspection. In response to identification of items with low significance, some panel bolts were tightened, and a nut and clamps were replaced.
- The shore barrier surveillances from 2003 to 2012 identified no discrepancies with the shore barrier. The only necessary action resulting from the inspections was debris removal from the beach, in some years. The shore barrier will be within the scope of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program.

The history of identification of degradation and initiation of corrective action prior to loss of intended function indicates that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program has been effective. The continued application of proven inspection methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program has been effective at identifying and managing the aging effects of loss of material of steel components; cracking, increase in porosity and permeability, loss of bond, loss of material, and loss of strength of concrete components; and loss of form, loss of material, and change in material properties of riprap and earthen and rock embankments associated with water-control structures. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.40 SELECTIVE LEACHING

Program Description

The Selective Leaching Program is a new program that will demonstrate the absence of selective leaching in a selected sample of components (i.e., 20 percent of the population with maximum of 25 components) fabricated from gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc or greater than 8 percent aluminum exposed to raw water, treated water, waste water, or soil. A sample population is defined as components with the same material and environment combination. Where practical, the sample population will focus on bounding or leading components most susceptible to aging due to time in service, severity of operating condition, and lowest design margin. The program will include a one-time visual inspection of selected components coupled with hardness measurement or other mechanical examination techniques such as destructive testing, scraping or chipping to determine whether loss of material is occurring due to selective leaching that may affect the ability of a component to perform its intended function during the period of extended operation.

Follow-up of unacceptable inspection findings will include an evaluation using the Corrective Action Program and possible expansion of the inspection sample size and location.

This inspection will be performed within five years prior to the period of extended operation.

NUREG-1801 Consistency

The Selective Leaching Program will be consistent with the program described in NUREG-1801, Section XI.M33, Selective Leaching, as modified by LR-ISG-2011-03.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Selective Leaching Program is a new program. Industry operating experience will be considered during implementation of this program. Plant operating experience will be gained as the program is executed and will be factored into the program via the confirmation and corrective action elements of the Fermi 2 10 CFR 50 Appendix B quality assurance program.

This inspection program applies to potential aging effects for which there is no operating experience at Fermi 2 indicating the need for an aging management program. The review of operating experience at Fermi 2 identified no occurrence of selective leaching. As stated in NUREG-1801, Revision 2, Section XI.M33, the inspection elements of this program (e.g., the scope of the inspections and inspection techniques) are consistent with industry practice. Accordingly, there is reasonable assurance that this new aging management program will be effective.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Selective Leaching Program will be effective at identifying and managing the aging effect of loss of material due to selective leaching since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. The Selective Leaching Program will provide reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.41 SERVICE WATER INTEGRITY

Program Description

The Service Water Integrity Program manages loss of material and fouling for safety-related service water system components fabricated from carbon steel, copper alloys, and stainless steel exposed to service water systems as described in the Fermi 2 response to NRC GL 89-13. The program includes (a) surveillance and control techniques to manage effects of biofouling, corrosion, various erosion mechanisms, and silting; (b) tests to verify heat transfer capability of heat exchangers important to safety; and (c) routine inspections and maintenance. System walkdowns are performed.

NUREG-1801 Consistency

The Service Water Integrity Program, with enhancement, is consistent with the program described in NUREG-1801, Section XI.M20, Open-Cycle Cooling Water System.

Exceptions to NUREG-1801

None

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Element Affected	Enhancement
4. Detection of Aging Effects	Revise Service Water Integrity Program procedures to include inspection to determine if loss of material due to erosion is occurring in the system.
9. Administrative Controls	Revise Service Water Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Operating Experience

The following discussion provides objective evidence that the Service Water Integrity Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The Service Water Integrity Program was formed to ensure the reliability of safety-related service water system components through compliance with GL 89-13. The following are examples of how operating experience is used to improve program effectiveness.

- In 2003, while conducting routine inspections and monitoring of the submerged components in the residual heat removal reservoir, loss of material due to external corrosion was observed on several pump columns. All ten safety-related pumps in the residual heat removal reservoir were replaced or refurbished.
- During inspection of the EDG service water piping in 2007, heavy nodules were observed that prompted an ultrasonic thickness survey. The survey determined that there were isolated areas where the pipe was degraded but remained capable of performing its intended function. Additional ultrasonic measurements were made to assess the extent of condition, and two additional sections of piping were replaced in RF14. In 2012, the EDG service water piping in the EDG rooms was replaced.
- During inspection of the #11 EDG heat exchanger in 2008, localized pitting was detected in the channels and associated piping. In 2011, EDG #11 heat exchanger channel was replaced, and the remaining heat exchanger channels were replaced in 2012.
- In 2009, industry operating experience was reviewed and determined to be relevant in plans to replace carbon steel service water piping with stainless steel piping. The lessons learned from the industry operating experience was a factor in the material selection for replacement service water piping.
- In 2012, operating experience led to the development of a leak evolution and prediction model as part of an overall fitness for service and life cycle management plan for the Service Water Integrity Program.
- In 2013, a direct visual examination was performed on buried piping in the residual heat removal service water systems. Visual and volumetric testing of the exposed piping was conducted, and a condition report was written for piping that did not meet the screening criteria. An evaluation found the piping acceptable for service and further action is planned.

As discussed in element 10 to NUREG-1801, Section XI.M20, this program considers the technical information and industry operating experience provided in NRC IN 85-30, IN 07-06, IN 85-24, IN 81-21, IN 86-96, IN 07-04, IN 07-28 and NRC GL 89-13.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide reasonable assurance that the Service Water Integrity Program will remain effective. The continued application of proven monitoring methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Service Water Integrity Program has been effective at identifying and managing aging effects of loss of material and fouling for components exposed to safety-related service water. The Service Water Integrity Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.42 STRUCTURES MONITORING

Program Description

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

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

Inspections are performed at a frequency sufficient to ensure there is no loss of intended function between inspections, and the program will be enhanced to perform inspections at least once every five years. The program contains provisions for increased inspection frequency and trending of structures and components in accordance with 10 CFR 50.65(a)(1), if the extent of degradation is such that the structure or component may not meet its design basis or, if degradation is allowed to continue uncorrected until the next normally scheduled assessment, the structure may not meet its design basis.

The program will be enhanced to perform periodic sampling and chemical analysis of ground water for pH, chlorides, and sulfates on a frequency of at least once every five years.

For surfaces provided with protective coatings, observation of the condition of the paint or coating is an effective method for identifying the absence of degradation of the underlying material. Therefore, monitoring of the condition of coatings on SSCs within the scope of the Structures Monitoring Program is implicitly included within that program.

NUREG-1801 Consistency

The Structures Monitoring Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.S6, Structures Monitoring Program.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program	Revise plant procedures to add the following structures to the program: • Condensate storage tank and condensate return tank foundations and retaining barrier • CTG-11 fuel oil storage tank foundation • Independent spent fuel storage installation (ISFSI) rail transfer pad • Manholes, handholes and duct banks • Shore barrier • Transformer and switchyard support structures and foundations Revise plant procedures to specify that the following list of in-scope structures are included in the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program (Section B.1.39): • General service water pump house • Residual heat removal complex • Shore barrier Revise plant procedures to ensure that masonry walls located in in-scope structures are included in the scope of the Masonry Wall Program (Section B.1.25).

Element Affected	Enhancement
1. Scope of Program (cont.)	Revise plant procedures to include a list of structural components and commodities within the scope of license renewal to be monitored in the program. Revise plant procedures to include periodic sampling and chemical analysis of ground water.
2. Preventive Actions	Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize the proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
3. Parameters Monitored or Inspected	Revise plant procedures to include the following parameters to be monitored or inspected: • For concrete structures, base inspections on quantitative requirements of industry codes (i.e., ACI 349.3R), standards and guidelines (i.e., ASCE 11) and consideration of industry and plant-specific operating experience. • For concrete structures and components include loss of material, loss of bond, increase in porosity and permeability, loss of strength, and reduction in concrete anchor capacity due to local concrete degradation. • For chemical analysis of ground water, monitor pH, chlorides, and sulfates. • Monitor gaps between the structural steel supports and masonry walls that could potentially affect wall qualification.

Element Affected	Enhancement
3. Parameters Monitored or Inspected (cont.)	Revise plant procedures to include the following components to be monitored for the associated parameters: • Structural bolting and anchors/fasteners (nuts and bolts) for loss of material, loose or missing nuts and/or bolts, and cracking of concrete around the anchor bolts. • Elastomeric vibration isolators and structural sealants for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening). Revise plant procedures to provide technical guidance for torque value requirements for specified bolting material subject to plant operating environments.
4. Detection of Aging Effects	Revise plant procedures to include the following: • Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R. • Visual inspection of elastomeric material should be supplemented by feel or touch to detect hardening if performance of the intended function of the elastomeric material is suspect. Include instructions to augment the visual examination of elastomeric material with physical manipulation of at least ten percent of available surface area. • Structures will be inspected at least once every five years. • Submerged structures will be inspected at least once every five years. • If normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring.

Element Affected	Enhancement
4. Detection of Aging Effects (cont.)	• Sampling and chemical analysis of ground water at least once every five years. The Structures Monitoring Program owner will review the results and evaluate any anomalies and perform trending of the results. • Masonry walls will be inspected at least once every five years, with provisions for more frequent inspections in areas where significant aging effects (i.e., missing blocks, cracking, etc.) are observed to ensure there is no loss of intended function between inspections. • Inspection of water-control structures should be conducted under the direction of qualified personnel experienced in the investigation, design, construction, and operation of these types of facilities. • Inspection of water-control structures on an interval not to exceed five years. • Perform special inspections of water-control structures immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls.
6. Acceptance Criteria	Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11 and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.

Operating Experience

The Structures Monitoring Program was implemented as required by 10CFR50.65. The program includes walkdowns and inspections of all structures in the maintenance rule scope.

Structure performance has been good. No structure has exceeded maintenance rule performance criteria since the maintenance rule program was established.

The initial structures walkdowns and inspections were conducted in 1996. Walkdowns and inspections were also conducted in 2002 and 2007–2008. Selected results of completed inspections follow.

- In 2007, during the maintenance rule structural walkdown of the circulating water pump house, degraded concrete areas were identified on the floor near the grating to the north of the pumps and on the outside of the wall near the southwest access door. The threshold at the southwest access door also needed repair. The degradations were cosmetic in nature, and repairs were recommended to prevent further degradation. As a result, work orders were initiated to correct these conditions.

- During this same period, walkdowns of the turbine building first floor identified two areas in need of repair. In the south reactor feed pump room, there were numerous small holes in the south wall and the west wall. In the gland steam condenser room, near the south wall, where there exists a bank of four floor penetrations, the seal for the eastern-most penetration was pushed down below floor level. These identified deficiencies were considered cosmetic in nature and were recommended for repair to prevent further degradation. The penetration repair was recommended to correct a potential trip hazard in the floor. Work orders were initiated to correct these deficiencies.

- During a structural walkdown inspection in 2007, two conduit support clamps were found missing from the RHR building roof. The deficiency was entered into the Corrective Action Program and was corrected.

- During a structural walkdown inspection in 2007, damage was observed on the concrete ceiling area around 1-inch wedge anchor bolts for a pipe support. It appeared that the 1-inch wedge anchor bolts on this support had been slightly pulled out of the concrete. The deficiency was entered into the Corrective Action Program and corrected.

- During inspection of watertight penetration seals in 2010, a small hole was found through the seal boot material on the sub-basement side of the penetration. The deficiency was entered into the Corrective Action Program and corrected. The evaluation determined there was no loss of function.

The Structures Monitoring Program is encompassed by the maintenance rule program. Self assessments, benchmarking, and QA audits of the maintenance rule program are routinely performed to ensure maintenance of high program standards.

The history of identification of degradation and initiation of corrective action prior to loss of intended function, along with identification of program deficiencies and subsequent corrective actions, provide reasonable assurance that the Structures Monitoring Program will remain effective. The continued application of proven inspection methods provides reasonable assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Structures Monitoring Program has been effective at identifying and managing the aging effects of change in material properties, cracking, loss of sealing, and reduction or loss of isolation function of elastomeric components; loss of material of steel and other metal components; and cracking, increase in porosity and permeability, loss of bond, loss of material, loss of strength, and reduction in concrete anchor capacity of concrete components associated with structures in the scope of the Structures Monitoring Program. The Structures Monitoring Program provides reasonable assurance that the effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.43 WATER CHEMISTRY CONTROL – BWR

Program Description

The Water Chemistry Control – BWR Program manages loss of material, cracking, and fouling in components exposed to a treated water environment through periodic monitoring and control of water chemistry. The Water Chemistry Control – BWR Program monitors and controls water chemistry parameters such as pH, chloride, conductivity, and sulfate. EPRI Report 1016579 is used to provide guidance.

The One-Time Inspection Program utilizes inspections or nondestructive evaluations of representative samples to verify that the Water Chemistry Control – BWR Program has been effective at managing aging effects. The representative sample includes low flow and stagnant areas.

NUREG-1801 Consistency

The Water Chemistry Control – BWR Program is consistent with the program described in NUREG-1801, Section XI.M2, Water Chemistry.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following examples of operating experience provide objective evidence that the Water Chemistry Control – BWR Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- Following replacement of the moisture separator reheaters (MSRs) in 2007, chemistry testing noted an increase in the iron concentration of reactor feedwater. Review and analysis confirmed the newly installed MSRs were the source of iron. The event has been entered into the Corrective Action Program The Water Chemistry Control – BWR Program is maintaining the insoluble iron levels within specification in the feedwater system.
- In 2010, chemistry samples indicated elevated sulfates in the reactor coolant. The cause was determined to be resin from a condensate filter demineralizer. The condensate filter

demineralizer was removed from service. The demineralizer septa bundle o-rings were determined to be displaced. The septa bundle was replaced.

- In 2011 during startup from a planned outage, chemistry samples indicated an increase in condensate chlorides and conductivity. Chloride and conductivity continued to increase, indicating circulating water in-leakage to the main condenser. In accordance with chemistry guidelines, an orderly plant shutdown was initiated. Repairs were made to the main condenser.

- In 2011, the on-line noble chemistry durability coupon was analyzed to determine platinum deposition, and results were compared with industry data. Fermi 2 platinum deposition of 0.02μg/cm^2 was midrange within the industry data base and provides effective mitigation. In addition, testing was performed to determine the optimum hydrogen water chemistry concentration.

- After the outage ending in March 2012, an evaluation was performed to document the impact of October 2010 to March 2012 chemistry transients against vessel internals, Class 1 piping, and nuclear fuel. The evaluation concluded that based on historical precedents, industry guidance, fuel inspections, vessel internal inspections, application of IGSCC mitigation strategies, and crack growth evaluations performed by a vendor, the impact of the Fermi 2 chemistry transients on the reactor pressure vessel, vessel internals, stainless steel piping (such as recirculation piping), control rod blade components, and fuel components was negligible.

As discussed in element 10 to NUREG-1801, Section XI.M2, this program considers the technical information and industry operating experience provided in Bulletin 80-13, IN 95-17, GL 94-03, and NUREG-1544.

The history of identification of out-of-specification chemistry parameters and initiation of corrective action, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Water Chemistry Control – BWR Program will remain effective. The continued application of proven monitoring methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Water Chemistry Control – BWR Program has been effective at identifying and managing aging effects of loss of material, cracking, and fouling for components in a treated water environment. The Water Chemistry Control – BWR Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.44 WATER CHEMISTRY CONTROL – CLOSED TREATED WATER SYSTEMS

Program Description

The Water Chemistry Control – Closed Treated Water Systems Program manages loss of material, cracking, and fouling in components exposed to a closed treated water environment, through monitoring and control of water chemistry, including the use of corrosion inhibitors, chemical testing, and visual inspections of internal surface condition. The EPRI Closed Cycle Cooling Guideline (1007820), industry guidance, and vendor recommendations are used to delineate the program.

NUREG-1801 Consistency

The Water Chemistry Control – Closed Treated Water Systems Program, with enhancements, is consistent with the program described in NUREG-1801, Section XI.M21A, Closed Treated Water Systems.

Exceptions to NUREG-1801

None

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope of Program	Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to include the following systems. • Process sampling system roughing cooler • CCHVAC chill water system
2. Preventive Actions	Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to provide chemical treatment including a corrosion inhibitor for the following systems in accordance with industry guidelines and vendor recommendations. • Process sampling system roughing cooler • CCHVAC chill water system

Element Affected	Enhancement
3. Parameters Monitored or Inspected 6. Acceptance Criteria	Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to specify water chemistry parameters monitored and the acceptable range of values for these parameters in accordance with EPRI 1007820, industry guidance, or vendor recommendations.
4. Detection of Aging Effects	Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to inspect accessible components whenever a closed treated water system boundary is opened. Ensure that a representative sample of piping and components is inspected at a frequency of at least once every ten years. These inspections will be conducted in accordance with applicable ASME Code requirements, industry standards, or other plant-specific inspection guidance by qualified personnel using procedures that are capable of detecting corrosion, fouling, or cracking. If visual examination identifies adverse conditions, then additional examinations, including ultrasonic testing, are conducted. Components inspected will be those with the highest likelihood of corrosion, fouling, or cracking. A representative sample is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components. Perform treated water sampling and analysis of the closed treated water systems per industry standards and in no case greater than quarterly unless justified with an additional analysis.

Operating Experience

Important chemistry parameters are routinely measured and trended as part of the water chemistry control for closed treated water systems. The following examples of operating experience provide objective evidence that the Water Chemistry Control – Closed Treated Water Systems Program will be effective in ensuring that component intended functions are maintained consistent with the current licensing basis during the period of extended operation.

- In 2005, chemistry personnel found an increase in bacterial count in the jacket coolant of an emergency diesel generator. The issue was entered into the Corrective Action Program and the coolant was replaced to correct the problem.
- In 2005, chemistry personnel found high dissolved oxygen in the turbine building closed cooling water (TBCCW) system due to high makeup rate. The issue was entered into the

Corrective Action Program. The high makeup rate was attributed to a leaking valve, which was repaired to correct the problem.

- In 2008 and 2009, chemistry personnel noted an increase in dissolved oxygen in the TBCCW system. The increase in dissolved oxygen was entered into the Corrective Action Program, and the suspected source of the oxygen, the east station air compressor, was repaired. Dissolved oxygen was reduced, but not to normal levels. The continued increase in dissolved oxygen level was entered into the Corrective Action Program, and the source of the oxygen was determined to be the center station air compressor. After its aftercooler was replaced, dissolved oxygen levels improved to within specification. TBCCW dissolved oxygen levels have been within specification from June 2011 until December 2013.
- In 2009, MIC was not being effectively addressed in EDG jacket cooling water, and contaminants were entering a few other critical systems. A contributing cause of these problems was that chemistry personnel had not recognized negative performance trends in a timely manner and had not taken actions to resolve those trends. Based on these concerns, the Water Chemistry Control – Closed Treated Water Systems Program was enhanced to better monitor negative trends in water chemistry.
- In 2004, due to high corrosion rates and suspended solids readings a corrosion inhibitor was added to the RBCCW, EECW, and supplemental cooling chilled water systems. Subsequently, the corrosion rate and suspended solid readings decreased with good results since 2005. In 2011–2013 reports, the corrosion rate was reported to be very low.

As discussed in element 10 to NUREG-1801, Section XI.M21A, this program considers the technical information and industry operating experience provided in NRC Licensee Event Reports 50-327/93-029-00 and 50-280/91-019-00.

The history of identification of out-of-specification chemistry parameters and initiation of corrective action, along with identification of program deficiencies and subsequent corrective actions, provide assurance that the Water Chemistry Control – Closed Treated Water Systems Program will remain effective. The continued application of these proven monitoring methods provides assurance that the effects of aging will be managed such that components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The process for review of future plant-specific and industry operating experience for aging management programs is discussed in Section B.0.4.

Conclusion

The Water Chemistry Control – Closed Treated Water Systems Program has been effective at managing aging effects of loss of material, cracking, and fouling for components in a treated water environment. The Water Chemistry Control – Closed Treated Water Systems Program provides reasonable assurance that effects of aging are managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.2 REFERENCES

B.2-1 U.S. Nuclear Regulatory Commission, NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 2, December 2010.

B.2-2 U.S. Nuclear Regulatory Commission, NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2, December 2010.

Appendix C

Response to BWRVIP Applicant Action Items

Fermi 2
License Renewal Application

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

BWRVIP-14-A	Evaluation of Crack Growth in BWR Stainless Steel RPV Internals
BWRVIP-18-A	BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines, Revision 1
BWRVIP-25	BWR Core Plate Inspection and Flaw Evaluation Guidelines
BWRVIP-26-A	BWR Top Guide Inspection and Flaw Evaluation Guidelines
BWRVIP-27-A	BWR Standby Liquid Control System / Core Plate ΔP Inspection and Flaw Evaluation Guidelines
BWRVIP-38	BWR Shroud Support Inspection and Flaw Evaluation Guidelines
BWRVIP-41	BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines, Revision 3
BWRVIP-47-A	BWR Lower Plenum Inspection and Flaw Evaluation Guidelines
BWRVIP-48-A	Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines
BWRVIP-49-A	Instrument Penetration Inspection and Flaw Evaluation Guidelines
BWRVIP-74-A	BWR Reactor Vessel Inspection and Flaw Evaluation Guidelines
BWRVIP-76	BWR Core Shroud Inspection and Flaw Evaluation Guidelines, Revision 1
BWRVIP-100-A	Updated Assessment of Fracture Toughness of Irradiated Stainless Steel for BWR Core Shroud

License renewal applicant action items identified in the corresponding SER for each of the above reports are addressed in the following table. BWRVIP documents without SERs for license renewal have no applicant action items and are therefore not included in the table. BWRVIP-14-A and BWRVIP-100-A also contain no applicant action items.

The SERs contain three common applicant action items, which are addressed only once in the table. For SERs that contain additional applicant action items, the response is provided separately following the responses to the three common action items.

Action Item Description	Response
Common Action Items from BWRVIP-18-A Rev. 1, -25, -26-A, -27-A, -38, -41 Rev. 3, -47-A, -48-A, -49-A, -74-A, -76 Rev. 1	
BWRVIP-All (1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within these BWRVIP reports described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP reports have been reviewed and Fermi 2 has been verified to be bounded by the reports. Additionally, Fermi 2 commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B. Deviation from a BWRVIP report approved by the NRC will be reported to the NRC per BWRVIP-94.
BWRVIP-All (2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs for the period of extended operation. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the programs and activities specified as necessary in the applicable BWRVIP reports are summarily described in the FSAR supplement.	The UFSAR supplement is included in LRA Appendix A and includes a summary of the programs and activities specified as necessary for the BWRVIP reports.

Action Item Description	Response
BWRVIP-All (3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. The applicable BWRVIP reports may state that there are no generic changes or additions to technical specifications associated with the report as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the inspection strategy described in the reports does not conflict with or result in any changes to their technical specifications. If technical specification changes or additions do result, then the applicant must ensure that those changes are included in its application for license renewal.	No technical specification changes have been identified for Fermi 2 based upon the BWRVIP reports.
Additional Action Items	
BWRVIP-18-A Rev. 1, Core Spray Internals Inspection and Flaw Evaluation Guidelines	
BWRVIP-18-A Rev. 1 (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.	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.

Action Item Description	Response
BWRVIP-25, Core Plate Inspection and Flaw Evaluation Guidelines	
BWRVIP-25 (4) Due to susceptibility of the rim hold-down bolts to stress relaxation, applicants referencing the BWRVIP-25 report for license renewal should identify and evaluate the projected stress relaxation as a potential TLAA issue.	For BWRs that do not have core plate wedges, BWRVIP-25 recommends evaluation of two aging effects on the core support plate hold-down bolts: loss of preload and cracking. Fermi 2 is a BWR 4 without core plate wedges, so these aging effects apply and are evaluated as follows. Prior to the period of extended operation, Fermi 2 will enhance the BWR Vessel Internals Program (refer to Appendix B, Section B.1.10) to perform one of the following. • Install core plate wedges prior to the period of extended operation, or • Complete a plant-specific analysis to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25 and submit the inspection plan, along with the acceptance criteria and justification for the inspection plan, to the NRC two years prior to the period of extended operation. The analysis of loss of preload on the core plate hold-down bolts does not meet the definition of a TLAA because the analysis does not involve time-limited assumptions defined by the current term of operation.
BWRVIP-25 (5) Until such time as an expanded technical basis for not inspecting the rim hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts.	Fermi 2 has requested a deviation for not inspecting the rim hold-down bolts, since inspection techniques are not currently viable to perform the inspections to verify the integrity of the bolts.

Action Item Description	Response
BWRVIP-26-A, Top Guide Inspection and Flaw Evaluation Guidelines	
BWRVIP-26-A (4) Due to IASCC susceptibility of the subject safety-related components, applicants referencing the BWRVIP-26 report for license renewal should identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue.	BWRVIP-26-A identified a fluence threshold of approximately 5 x 10^{20} (E > 1 MeV) for irradiation assisted stress corrosion cracking (IASCC) for the top guide. BWRVIP-26-A also states that all GE BWR/2s through BWR/6s have reached or surpassed this fluence threshold at the top guide grid beam locations. BWRVIP-26-A does not constitute a TLAA for Fermi 2 since it was not used to make any safety determination or to justify reducing the number of inspections.
BWRVIP-27-A, Standby Liquid Control System / Core Plate ΔP Internals Inspection and Flaw Evaluation Guidelines	
BWRVIP-27-A (4) Due to the susceptibility of the subject components to fatigue, applicants referencing the BWRVIP-27 report for license renewal should identify and evaluate the projected fatigue cumulative usage factors as a potential TLAA issue.	The BWRVIP-27-A fatigue analysis of the SLC/core ΔP line for 60 years of operation is a TLAA. The NRC SER (BWRVIP-27-A, Appendix D) states that fatigue and the projected CUF should be addressed by each applicant for license renewal but recognizes that this fatigue analysis is not required for all SLC/core ΔP configurations. At Fermi 2, the SLC/core ΔP lines inside the reactor vessel are not subject to aging management review. Refer to LRA Section 4.3.1.4 for further discussion of fatigue and CUFs for the reactor vessel internals for the period of extended operation.

Action Item Description	Response
BWRVIP-47-A, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines	
BWRVIP-47-A (4) Due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for LR [license renewal] should identify and evaluate the projected CUF as a potential TLAA issue.	BWRVIP-47-A identified fatigue analyses, especially of lower plenum pressure boundary components, as a potential TLAA. Fermi 2 has a fatigue evaluation (calculated CUF) for selected lower plenum components. TLAA issues identified for the reactor vessel internals have been evaluated for Fermi 2 in LRA Section 4.3.1.4.
BWRVIP-74-A, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines	
BWRVIP-74-A (4) The staff is concerned that leakage around the reactor vessel seal rings could accumulate in the [vessel flange leak detection] VFLD lines, cause an increase in the concentration of contaminants and cause cracking in the VFLD line. The BWRVIP-74 report does not identify this component as within the scope of the report. However, since the VFLD line is attached to the RPV and provides a pressure boundary function, LR applicants should identify an AMP for the VFLD line.	The vessel flange leak detection (VFLD) line is within the scope of license renewal and subject to aging management review. Loss of material and cracking are identified as aging effects requiring management. Aging of the vessel flange leak detection line is managed by the Water Chemistry Control – BWR Program as verified by the One-Time Inspection Program. Programs are described in LRA Appendix B.
BWRVIP-74-A (5) LR applicants shall describe how each plant-specific aging management program addresses the following elements: (1) scope of program, (2) preventive actions, (3) parameters monitored and inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	Descriptions of plant-specific aging management programs in LRA Appendix B address the required ten elements.

Action Item Description	Response
BWRVIP-74-A (6) The staff believes inspection by itself is not sufficient to manage cracking. Cracking can be managed by a program that includes inspection and water chemistry. BWRVIP-29 describes a water chemistry program that contains monitoring and control guidelines for BWR water that is acceptable to the staff. BWRVIP-29 is not discussed in the BWRVIP-74 report. Therefore, in addition to the previously discussed BWRVIP reports, LR applicants shall contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry that are contained in BWRVIP-29.	The Water Chemistry Control – BWR Program, described in LRA Appendix B, Section B.1.43, monitors and controls reactor water chemistry in accordance with the guidelines of BWRVIP-190, which supercedes BWRVIP-29.
BWRVIP-74-A (7) LR applicants shall identify their vessel surveillance program, which is either an ISP or plant-specific-invessel surveillance program, applicable to the LR term.	Fermi 2 has received NRC approval to use the BWRVIP ISP. This has been applied to the Reactor Vessel Surveillance Program, discussed in LRA Appendix B, Section B.1.38.
BWRVIP-74-A (8) LR applicants should verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue usage is projected to exceed 1.0 will require case-by-case staff review and approval. Further, a LR applicant must address environmental fatigue for the components listed in the BWRVIP-74 report for the LR period.	Fatigue during the period of extended operation (including thermal cycles and environmentally assisted fatigue) has been evaluated for Fermi 2. See the Fatigue Monitoring Program in LRA Appendix B, Section B.1.17.

Action Item Description	Response
BWRVIP-74-A (9) Appendix A to the BWRVIP-74 report indicates that a set of P-T curves should be developed for the heat-up and cool-down operating conditions in the plant at a given EFPY in the LR period.	Development of pressure-temperature limits for the period of extended operation has been evaluated as a TLAA in LRA Section 4.2.3. Pressure-temperature limit curves will continue to be updated, as required by Appendix G of 10 CFR Part 50. The effects of aging associated with the TLAA for the pressure-temperature limits will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).
BWRVIP-74-A (10) To demonstrate that the beltline materials meet the Charpy USE criteria specified in Appendix B of the report, the applicant shall demonstrate that the percent reduction in Charpy USE for their beltline materials are less than those specified for the limiting BWR/3-6 plates and the non-Linde 80 submerged arc welds and that the percent reduction in Charpy USE for their surveillance weld and plate are less than or equal to the values projected using the methodology in RG 1.99, Revision 2.	Upper shelf energy (USE) is evaluated for beltline materials as discussed in LRA Section 4.2.4. Fracture toughness criteria in 10 CFR 50 Appendix G requires that beltline materials maintain USE no less than 50 ft-lb during operation of the reactor. The 52 EFPY USE values for the beltline materials were determined using methods consistent with RG 1.99. The value of peak ¼T fluence is used. For the extended operating term, Fermi 2 beltline materials were evaluated using Regulatory Guide 1.99 Revision 2. The calculations were based upon the peak ¼T fluence for 52 EFPY, and where appropriate, adjusted by a factor for the axial location. In order to assure that the weld materials meet all RG 1.99 requirements for end of license USE, Position 2.2 was applied to all beltline weld materials. The results of this evaluation demonstrate that all beltline materials remain above 50 ft-lbs. The TLAA for upper shelf energy has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Action Item Description	Response
BWRVIP-74-A (11) To obtain relief from the in-service inspection of the circumferential welds during the LR period, the BWRVIP report indicates each licensee will have to demonstrate that (1) at the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure frequency for circumferential welds in the Appendix E for the staff's July 28, 1998, FSER, and (2) that they have implemented operator training and established procedures that limit the frequency of cold overpressure events to the amount specified in the staff's FSER.	Fermi 2 has received relief from the in-service inspection of the circumferential welds for the remaining term of the original operating license. A request for extension of this relief for the extended operating period will be submitted to the NRC in accordance with 10 CFR 50.55(a). See LRA Section 4.2.5.
BWRVIP-74-A (12) As indicated in the staff's March 7, 2000, letter to Carl Terry, an LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in Table 1 of this FSER.	The projected 52 EFPY Fermi 2 mean ART (66°F) is less than the bounding 114°F shown in the NRC SER for BWRVIP-74 (based on a calculation performed to identify the mean RT_{NDT} value required to provide a result which closely matches the RPV failure frequency of 5E-6 per reactor-year). This analysis has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) as discussed in LRA Section 4.2.6.
BWRVIP-74-A (13) The Charpy USE, P-T limit, circumferential weld and axial weld RPV integrity evaluations are all dependent upon the neutron fluence. The applicant may perform neutron fluence calculations using staff-approved methodology or may submit the methodology for staff review. If the applicant performs the neutron fluence calculation using a methodology previously approved by the staff, the applicant should identify the NRC letter that approved the methodology.	The method used for the neutron fluence calculation adheres to the guidance prescribed in Regulatory Guide (RG) 1.190. The TLAA for neutron fluence in the RPV beltline has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) as discussed in LRA Section 4.2.1.

Action Item Description	Response
BWRVIP-74-A (14) Components that have indications that have been previously analytically evaluated in accordance with subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period shall be reevaluated for the 60-year service period corresponding to the LR term.	Fermi 2 has performed an analysis for reactor vessel flaw indications identified in RF09 (2003) and RF12 (2007). The analysis determined that the bounding indication is acceptable in the as-is condition for 52 EFPY with consideration of the effects of the power uprate from measurement uncertainty recapture (MUR/TPO). Therefore, this is a TLAA that has been extended to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) as discussed in LRA Section 4.7.5.
BWRVIP-76 Rev. 1, BWR Core Shroud Inspection and Flaw Evaluation Guidelines	
BWRVIP-76 Rev. 1 (4) The applicants shall reference the NRC staff approved TRs BWRVIP-14-A, BWRVIP-99 (when approved) and BWRVIP-100-A in their RVI components' AMP. The applicants shall make a statement in their LRAs that the crack growth rate evaluations and fracture toughness values specified in these reports shall be used for cracked core shroud welds that are exposed to the neutron fluence values that are specified in these TRs. The applicants shall confirm that they will incorporate any emerging inspection guidelines developed by the BWRVIP for these welds.	The Fermi 2 BWR Vessel Internals Program discussed in LRA Appendix B, Section B.1.10, references BWRVIP-14-A, BWRVIP-99-A, and BWRVIP-100-A. The crack growth rate evaluations and fracture toughness values specified in these reports are used for cracked core shroud welds that are exposed to the neutron fluence values specified in these BWRVIP reports. Any emerging inspection guidelines developed by the BWRVIP for these welds are incorporated into this program.
BWRVIP-76 Rev. 1 (5) LR applicants that have core shrouds with tie rod repairs shall make a statement in their AMPs associated with the RVI components that they have evaluated the implications of the Hatch Unit 1 tie rod repair cracking on their units and incorporated revised inspection guidelines, if any, developed by the BWRVIP.	Fermi 2 does not have a core shroud with tie rod repairs.

Action Item Description	Response
BWRVIP-76 Rev. 1 (6) The NRC staff's guidance in Table IV.B1 of the GALL Report lists two potentially applicable aging effects (i.e., in addition to cracking) for generic BWR reactor vessel internal components (including BWR core shroud and core shroud repair assembly components) that are made from either stainless steel (including CASS) or nickel alloy: (1) loss of material due to pitting and crevice corrosion (Refer to GALL AMR IV.B1-15), and (2) cumulative fatigue damage (Refer to GALL AMR item IV.B1-14). BWR LR applicants will need to assess their designs to see if the generic guidelines for managing cumulative fatigue damage in GALL AMR item IV.B1-14 and for management loss of material due to pitting and crevice corrosion in GALL AMR IV.B1-15 are applicable to the design of their core shroud components (including welds) and any core shroud repair assembly components that have been installed through a design modification of the plant. If these aging effects are applicable to the design of these components as a result of exposing them to a reactor coolant with integrated neutron flux environment, applicants for license renewal will need to: (1) identify the aging effects as aging effects requiring management (AERM) for the core shrouds and for their core shroud repair assembly components if a repair design modification has been implemented, and (2) identify the specific aging management programs or time-limited aging analyses that will be used to manage these aging effects during the period of extended operation. Refer to License Renewal Applicant Action Item 7) for additional guidance on identifying the AERMs for core shroud components or core shroud repair assembly components that made from materials other than stainless steel (including CASS) or nickel alloy.	 The Fermi 2 core shroud is fabricated from Type 304L stainless steel. The aging effects of loss of material and cumulative fatigue damage have been identified for the core shroud. The BWR Vessel Internals Program and Water Chemistry Control – BWR Program have been credited to manage loss of material due to pitting and crevice corrosion. Fermi 2 has not experienced any cracking of the shroud vertical or horizontal welds. Therefore, a repair design modification has not been implemented. Fermi 2 addresses fatigue of the reactor vessel internals for the period of extended operation in LRA Section 4.3.1.4.

Action Item Description	Response
BWRVIP-76 Rev. 1 (7) For BWR LRAs identification of AERMs for core shroud components or core shroud repair assembly components that are made from materials other than stainless steel (including CASS) or nickel alloy will need to be addressed on a plant specific basis that is consistent with the Note format criteria for plant-specific AMR items in latest NRC-approved version TR NEI-95-10.	Not applicable. The Fermi 2 core shroud is fabricated from Type 304L stainless steel, and no repair hardware has been installed.
BWRVIP-76 Rev. 1 (8) LR applicants shall reference the NRC staff-approved topical reports BWRVIP-99 and BWRVIP-100-A in their RVI components' AMP, as discussed in section 3.3 of this SER.	BWRVIP-99 and BWRVIP-100-A are referenced in the BWR Vessel Internals Program discussion in LRA Appendix B, Section B.1.10.