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LRA Changes for LRA Annual Update and RAI Set 28

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Changes made to update Table 2.1-2 to update the status of LR-ISG-2011-04 and add LR-ISG-2012-02.

Table 2.1-2 (Page 2.1-22) is revised as follows (new text shown underlined and deleted text shown in strikethrough):

Table 2.1-2 NRC Interim Staff Guidance Associated with License Renewal

Issue Number	Purpose	Discussion Status
LR-ISG-2006-03	Staff Guidance for Preparing Severe Accident Mitigation Alternatives (SAMA) Analyses	The staff has issued LR-ISG-2006-03.
LR-ISG-2011-01	Aging Management of Stainless Steel Structures and Components in Treated Borated Water	The staff has issued LR-ISG-2011-01.
LR-ISG-2011-02	Aging Management Program for Steam Generators	The staff has issued LR-ISG-2011-02.
LR-ISG-2011-03	Aging Management Program for Buried and Underground Piping and Tanks	The staff has issued LR-ISG-2011-03.
LR-ISG-2011-04	Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors	~~This ISG has been issued in draft for public comment.~~ The staff has issued LR-ISG-2011-04
LR-ISG-2011-05	Ongoing Review of Operating Experience	The staff has issued LR-ISG-2011-05.
LR-ISG-2012-01	Wall Thinning Due to Erosion Mechanisms	The staff has issued LR-ISG-2012-01.
LR-ISG-2012-02	Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation	The staff has issued LR-ISG-2012-02.

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Changes made to update Section 2.1.5.5 on LR-ISG-2011-04 and add Section 2.1.5.8 on LR-ISG-2012-02.

Section 2.1.5.5 (Page 2.1-23) and Section 2.1.5.8 (Page 2.1-23) are revised as follows (new text shown underlined and deleted text shown in strikethrough):

2.1.5.5. (LR-ISG-2011-04) Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors

This LR-ISG was issued ~~in draft~~ as final and is applicable to Callaway. The aging management program for the reactor vessel internal components is discussed in Section B2.1.6, *PWR Vessel Internals*. Results are provided in Chapter 3, *Aging Management Review*.

2.1.5.8. (LR-ISG-2012-02) Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation

This LR-ISG was issued as final and is applicable to Callaway. The applicable aging management programs are discussed in Section B2.1.10, *Open-Cycle Cooling Water System*, Section B2.1.14, *Fire Water System*, Section B2.1.15, *Aboveground Metallic Tanks*, Section B2.1.21, *External Surfaces Monitoring of Mechanical Components*, and Section B2.1.23, *Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Systems*.

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Changes made to Section 3.2.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs (AMPs), as a result of LR-ISG-2012-02 changes.

Section 3.2.2.1 in Chapter V of NUREG-1801 for Engineered Safety Features, (Page 3.2-2 thru 3.2-8) is revised to add the materials, environments, aging effects requiring management and (AMPs) to the sections indicated.

3.2.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs (AMPs)

Loss of Material and Cracking	
3.2.2.1.4	Containment Purge System
3.2.2.1.5	High Pressure Coolant Injection System
Reduced Thermal Insulation Resistance	
3.2.2.1.6	Residual Heat Removal system

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Add a new section for the further evaluation for loss of material due to recurring internal corrosion.

Further Evaluation 3.2.2.2.9 (Page 3.2-10) is added as follows (new text shown underlined):

3.2.2.2.9 Loss of Material Due to Recurring Internal Corrosion

Operating experience associated with Engineered Safety Features Systems and associated aging management programs does not meet the threshold for significance of aging effect or frequency of occurrence of the aging effect to be considered as recurring internal corrosion.

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Changes made to corporate aging management of the refueling water storage tanks by the Aboveground Metallic tanks program.

Table 3.2-1, Summary of Aging Management Programs in Chapter V of NUREG-1801 for Engineered Safety Features, (Page 3.2-33) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.2-1 Summary of Aging Management Programs in Chapter V of NUREG-1801 for Engineered Safety Features

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1.066	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 (See Subsection 3.2.2.2.9)	Not applicable. Callaway has no in-scope components subject to recurring internal corrosion in the engineered safety features, so the applicable NUREG-1801 lines were not used.
3.2.1.067	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	Cracking due to stress corrosion cracking	Aboveground Metallic Tanks (B2.1.15)	No	Not applicable. Callaway has no in-scope uninsulated stainless steel or aluminum tanks greater than 100,000 gallons exposed to soil, concrete, or external environments engineered safety features, so the applicable NUREG-1801 lines were not used.

Table 3.2-1 Summary of Aging Management Programs in Chapter V of NUREG-1801 for Engineered Safety Features

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1.068	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, and crevice corrosion	Aboveground Metallic Tanks (B2.1.15)	No	Not applicable. Callaway has no in-scope uninsulated steel, stainless steel or aluminum tanks greater than 100,000 gallons exposed to soil, concrete, or external environments engineered safety features, so the applicable NUREG-1801 lines were not used.
3.2.1.069	Insulated steel, stainless steel, copper alloy, or aluminum, 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	External Surfaces Monitoring of Mechanical Components (B2.1.21) or Aboveground Metallic Tanks (B2.1.15) (for tanks only)	No	Consistent with NUREG-1801.

Table 3.2-1 Summary of Aging Management Programs in Chapter V of NUREG-1801 for Engineered Safety Features

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1.070	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	Aboveground Metallic Tanks (B2.1.15)	No	Consistent with NUREG-1801.
3.2.1.071	Insulated stainless steel, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor	Cracking due to stress corrosion cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21) or Aboveground Metallic Tanks (B2.1.15) (for tanks only)	No	Consistent with NUREG-1801.

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Changes made to add LR-ISG-2012-02 aging evaluation lines for insulated piping

Table 3.2.2-2 (Page 3.2-38) is revised as follows (new text shown underlined):

Table 3.2.2-2 Engineered Safety Features – Summary of Aging Management Evaluation – Containment Integrated Leak Rate Testing System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	V.C.E-403	3.2.1.069	A

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Changes made to add LR-ISG-2012-02 aging evaluation lines for insulated piping.

Table 3.2.2-4 (Page 3.2-48) is revised as follows (new text shown underlined):

Table 3.2.2-4 Engineered Safety Features – Summary of Aging Management Evaluation – Containment Purge System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
<u>Piping</u>	<u>LBS</u>	<u>Carbon Steel</u>	<u>Condensation (Ext)</u>	<u>Loss of material and cracking</u>	<u>External Surfaces Monitoring of Mechanical Components (B2.1.21)</u>	<u>VII.F3.A-405</u>	<u>3.3.1.132</u>	<u>A</u>

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Changes made to add LR-ISG-2012-02 aging evaluation lines for insulated piping and tanks

Table 3.2.2-5 (Page 3.2-59, 3.2-63, and 3.2-66) is revised as follows (deleted text shown in strikethrough and new text shown underlined):

Table 3.2.2-5 Engineered Safety Features – Summary of Aging Management Evaluation – High Pressure Coolant Injection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	PB, LBS, SIA	Stainless Steel	Condensation (Ext)	Cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	V.D1.E-406	3.2.1.071	A
Piping	PB, LBS, SIA	Stainless Steel	Condensation (Ext)	Loss of Material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	V.D1.E-403	3.2.1.069	A

Table 3.2.2-5 Engineered Safety Features – Summary of Aging Management Evaluation – High Pressure Coolant Injection System (cont.)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Tank	PB	Stainless Steel	Atmosphere/ Weather (Ext)	~~Cracking~~ Loss of material and Cracking	Aboveground Metallic Tanks (B2.1.15)	~~V.D1.EP-103~~ VIII.E.SP-138	~~3.2.1.007~~ 3.4.1.030	~~E, 1~~ A
~~Tank~~	~~PB~~	~~Stainless Steel~~	~~Atmosphere/ Weather (Ext)~~	~~Loss of material~~	~~Aboveground Metallic Tanks (B2.1.15)~~	~~V.D.EP-107~~	~~3.2.1.004~~	~~E, 1~~
Tank	PB	Stainless Steel	Concrete (Ext)	Loss of material and Cracking	Aboveground Metallic Tanks (B2.1.15)	VIII.E.SP-137	3.4.1.031	~~B~~ A
~~Tank~~	~~PB~~	~~Stainless Steel~~	~~Condensation (Int)~~	~~Loss of material~~	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~	~~V.D1.EP-81~~	~~3.2.1.048~~	~~D~~
~~Tank~~	~~PB~~	~~Stainless Steel~~	~~Treated Borated Water (Int)~~	~~Cracking~~	~~Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)~~	~~V.A.E-12~~	~~3.2.1.020~~	~~A~~
Tank	PB	Stainless Steel	Treated Borated Water (Int)	Loss of material	~~Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)~~ Aboveground Metallic Tanks (B2.1.15)	~~VD.1.EP-41~~ V.D.1.E-404	~~3.2.1.022~~ 3.2.1.070	A

Notes for Table 3.2.2-5:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

Plant Specific Notes:

None

~~1 The bottom of this tank rests on a concrete foundation. Therefore, the Aboveground Metallic Tanks program (B2.1.15) is credited.~~

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Changes made to revise aging evaluation lines for insulation based on LR-ISG-2012-02

Table 3.2.2-6 (Page 3.2-72) is revised as follows (deleted text shown in strikethrough and new text shown underlined):

Table 3.2.2-6 Engineered Safety Features – Summary of Aging Management Evaluation – Residual Heat Removal System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat Exchanger (Residual Heat Removal)	PB	Carbon Steel	Closed Cycle Cooling Water (Int)	Cumulative fatigue damage	Time-Limited Aging Analysis evaluated for the period of extended operation	None	None	H, 1~~2~~
Heat Exchanger (Residual Heat Removal)	PB	Stainless Steel	Treated Borated Water (Int)	Cumulative fatigue damage	Time-Limited Aging Analysis evaluated for the period of extended operation	None	None	H, 1~~2~~
Insulation	INS	Insulation Calcium Silicate	Plant Indoor Air (Ext)	~~None~~ Reduced thermal insulation resistance	~~None~~ External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~None~~ VIII.I.S-403	~~None~~ 3.4.1.064	~~J, 2~~ A

Notes for Table 3.2.2-6:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

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

Plant Specific Notes:

~~1 Based on plant operating experience, there are no aging effects requiring management for calcium silicate insulation in a metal jacket in a plant indoor air environment. The insulation does not experience aging effects unless exposed to temperatures, radiation, or chemicals capable of attacking the specific chemical composition of the insulation. The insulation is contained in metal jacket with a vapor barrier to prevent moisture intrusion and is in a non-aggressive air environment that does not experience significant aging effects.~~

1~~2~~ These TLAAs are applicable to the Class 2 Heat Exchangers. Section 4.3.8 describes the evaluation of these TLAAs.

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Changes made to Section 3.3.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs (AMPs), as a result of aging management of components with internal coatings and LR-ISG-2012-02 changes.

Section 3.3.2.1 in Chapter VII of NUREG-1801 for Auxiliary Systems, (Page 3.3-4 thru 3.3-35) is revised to add the materials, environments, aging effects requiring management and (AMPs) to the sections indicated.

3.3.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs (AMPs)

Concrete Environment	
3.3.2.1.2	Fuel Pool Cooling and Cleanup System
Carbon Steel (with Coating or Lining)	
3.3.2.1.4	Essential Service Water System
3.3.2.1.5	Service Water System
3.3.2.1.7	Component Cooling Water System
3.3.2.1.11	Control Building HVAC System
3.3.2.1.20	Fire Protection System
Condensation	
3.3.2.1.14	Fuel Building HVAC System
3.3.2.1.19	Containment Cooling System
Loss of Material and Flow Blockage	
3.3.2.1.20	Fire Protection System

Loss of Material and Cracking	
3.3.2.1.4	Essential Service Water System
3.3.2.1.10	Chemical and Volume Control System
3.3.2.1.11	Control Building HVAC System
3.3.2.1.13	Auxiliary Building HVAC System
3.3.2.1.14	Fuel Building HVAC System
3.3.2.1.15	Miscellaneous Buildings HVAC System
3.3.2.1.19	Containment Cooling System
3.3.2.1.20	Fire Protection System
3.3.2.1.28	Miscellaneous Systems in Scope ONLY for Criterion 10 CFR 54.4(a)(2)
Reduced Thermal Insulation Resistance	
3.3.2.1.22	Standby Diesel Generator Engine System
3.3.2.1.10	Chemical and Volume Control System

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Add a new section for the further evaluation for loss of material due to recurring internal corrosion.

Further Evaluation 3.3.2.2.8 (Page 3.3-36) is added as follows (new text shown underlined):

3.3.2.2.8 Loss of Material Due to Recurring Internal Corrosion

Actions have been taken to address examples of recurring corrosion due to MIC in the Open-Cycle Cooling Water System program (B2.1.10). Low Frequency Electromagnetic Technique (LFET) is used for screening large areas of piping to detect changes in the wall thickness of the pipe. Thinned areas found during the LFET scan are followed up with pipe wall thickness examinations. In addition to the pipe wall thickness examination, opportunistic visual inspections of the ESW system are also performed whenever the ESW system is opened for maintenance. Prior to the period of extended operation, an inspection technique will be selected from available technologies to identify internal pipe wall degradation due to MIC for performance of a one-time inspection of a buried carbon steel piping segment that is representative of other accessible carbon steel ESW piping segments.

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Changes made to discussion column as a result of aging management of components with internal coatings and LR-ISG-2012-02 changes for recurring internal corrosion, corrosion under insulation, and Fire Water System AMP, and Aboveground Metallic Tanks AMP.

Table 3.3-1, Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems, (Pages 3.3-51, 3.3-58 through 3.3-60, 3.3-66, and 3.3-81) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1.037	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	Open-Cycle Cooling Water System (B2.1.10)	No	Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23) <u>or Fire Water System (B2.1.14)</u> is credited for those components not managed by the Open-Cycle Cooling Water System (B2.1.10) program.

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1.064	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	Fire Water System (B2.1.14)	No	Consistent with NUREG-1801 with aging management program exceptions. **The aging management program(s) with exceptions to NUREG-1801 include: Fire Water System (B2.1.14)
3.3.1.065	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	Fire Water System (B2.1.14)	No	Not applicable. Callaway has no in-scope aluminum piping, piping components or piping elements exposed to raw water in the ~~fire protection system~~ auxiliary systems, so the applicable NUREG-1801 line was not used.
3.3.1.066	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	Fire Water System (B2.1.14)	No	Consistent with NUREG-1801 with aging management program exceptions. The aging management program(s) with exceptions to NUREG-1801 include: Fire Water System (B2.1.14)

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1.067	Steel Tanks exposed to Air – outdoor (External)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Metallic Tanks (B2.1.15)	No	Not applicable. Other than the fire water storage tanks that are managed by the fire water system program (B2.1.14), Callaway has no in-scope steel tanks greater than 100,000 gallons exposed to an outdoor air environment within the auxiliary systems, so the applicable NUREG-1801 line was not used. ~~Consistent with NUREG-1801 with aging management program exceptions. The aging management program(s) with exceptions to NUREG-1801 include: Aboveground Metallic Tanks (B2.1.15).~~

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1.072	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	Selective Leaching (B2.1.19)	No	Consistent with NUREG-1801 with aging management program exceptions. The aging management program(s) with exceptions to NUREG-1801 include: Selective Leaching (B2.1.19)
3.3.1.089	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 (B2.1.14) or other components: Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	No	Consistent with NUREG-1801 with aging management program exceptions. The aging management program(s) with exceptions to NUREG-1801 include: Fire Water System and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23) (B2.1.14)

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
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 (See Subsection 3.3.2.2.8)	Consistent with NUREG-1801.The plant-specific aging management program(s) used to manage the aging include: Open-Cycle Cooling Water System (B2.1.10)**See further evaluation in Section 3.3.2.2.8.
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)	Aboveground Metallic Tanks (B2.1.15)	No	Not applicable. Other than the fire water storage tanks that are managed by the fire water system program (B2.1.14), Callaway has no in-scope steel, stainless steel, or aluminum tanks greater than 100,000 gallons exposed to a soil or concrete, or external environments within the auxiliary systems, so the applicable NUREG-1801 line was not used.

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
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.	Aboveground Metallic Tanks (B2.1.15)	No	Not applicable. Other than the fire water storage tanks that are managed by the fire water system program (B2.1.14), Callaway has no in-scope steel tanks greater than 100,000 gallons exposed to a soil or concrete; air-indoor uncontrolled, raw water, treated water, waste water, condensation environments within the auxiliary systems, so the applicable NUREG-1801 line was not used.
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	Fire Water System (B2.1.14)	No	Consistent with NUREG-1801 with aging management program exceptions. **The aging management program(s) with exceptions to NUREG-1801 include: Fire Water System (B2.1.14)

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
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	Fire Water System (B2.1.14)	No	Consistent with NUREG-1801 with aging management program exceptions. The aging management program(s) with exceptions to NUREG-1801 include: Fire Water System (B2.1.14)
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)	External Surfaces Monitoring of Mechanical Components (B2.1.21) or Aboveground Metallic Tanks (B2.1.15) (for tanks only)	No	Consistent with NUREG-1801.

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1.133	Underground HDPE piping, piping components, and piping elements in an air-indoor uncontrolled or condensation (external) environmen	Cracking, blistering, change in color due to water absorption	Buried and Underground Piping and Tanks (B2.1.25)	No	Consistent with NUREG-1801.
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	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	No	Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program External Surfaces Monitoring of Mechanical Components (B2.1.23) is credited for the submerged service water pumps because the material and environment combinations are the same for the internal and external surfaces.
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	External Surfaces Monitoring of Mechanical Components (B2.1.21)	No	Consistent with NUREG-1801.

Table 3.3-1 Summary of Aging Management Programs in Chapter VII of NUREG-1801 for Auxiliary Systems

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	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)	Fire Water System (B2.1.14)	No	Consistent with NUREG-1801 with aging management program exceptions. **The aging management program(s) with exceptions to NUREG-1801 include: Fire Water System (B2.1.14)
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	Aboveground Metallic Tanks (B2.1.15)	No	Not applicable. Other than the fire water storage tanks that are managed by the fire water system program (B2.1.14), Callaway has no in-scope steel, stainless steel, or aluminum tanks greater than 100,000 gallons exposed to treated water or treated borated water within the auxiliary systems, so the applicable NUREG-1801 line was not used.

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Changes made to add submerged piping and piping embedded in concrete

Table 3.3.2-2 (Pages 3.3-88, and 3.3-89) is revised as follows (new text shown underlined):

Table 3.3.2-2 Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	PB	Stainless steel	Concrete	None	None	VII.J.AP-19	3.3.1.120	A
Piping	PB	Stainless steel	Treated Borated Water (External)	Cracking	Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)	VII.A3.A-56	3.3.1.124	A
Piping	PB	Stainless steel	Treated Borated Water (External)	Loss of material	Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)	VII.A3.AP-79	3.3.1.125	A

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Changes made to add LR-ISG-2012-02 aging evaluation lines for identification of components with internal coatings, recurring internal corrosion, corrosion under insulation, and underground HDPE piping.

Table 3.3.2-4 (Pages 3.3-94, 3.3-97 through 3.3-98) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-4 Auxiliary Systems – Summary of Aging Management Evaluation – Essential Service Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS, PB, SIA	Carbon Steel	Raw Water (Int)	Loss of material	Open-Cycle Cooling Water System (B2.1.10)	VII.C1.A-400	3.3.1.127	E, 5
Piping	PB	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.C1.A-405	3.3.1.132	A
Piping	LBS, PB, SIA	Carbon Steel	Raw Water (Int)	Wall thinning	Open-Cycle Cooling Water System (B2.1.10)	VII.C1.A-409	3.3.1.126	~~E, 4~~ E, 3
Piping	PB	HDPE	Buried (Ext)	Cracking	Time-Limited Aging Analysis evaluated for the period of extended operation	None	None	~~H, 4~~ H, 3
Piping	PB	HDPE	Underground (Ext)	Cracking, blistering, change in color	Buried and Underground Piping and Tanks (B2.1.25)	~~None~~ VII.I.A-406	~~None~~ 3.3.1.133	~~G, 2~~ A

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	PB	HDPE	Plant Indoor Air (Ext)	None	None	None	None	~~G, 3~~ G, 2
Strainer	FIL, PB	Carbon Steel (with coating or lining)	Plant Indoor Air (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.I.A-77	3.3.1.078	A
Strainer	FIL, PB	Carbon Steel (with coating or lining)	Raw Water (Int)	Loss of material	Open-Cycle Cooling Water System (B2.1.10)	VII.C1.AP-194	3.3.1.037	A

Notes for Table 3.3.2-4:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E Consistent with NUREG-1801 for 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.

Plant Specific Notes:

1 External Surfaces Monitoring of Mechanical Components program (B2.1.21) is used instead of Open Cycle Cooling Water program (B2.1.10) to manage the aging of the external surfaces of nonsafety-related components exposed to raw water.

~~2 HDPE piping is in an underground vault and potentially exposed to groundwater.~~

~~3~~2 HDPE components in a plant indoor air environment are not exposed to an aggressive chemical environment that would concentrate contaminants and degrade HDPE chemical and mechanical properties. HDPE is not exposed to ozone, ionizing radiation or a UV source (sunlight or fluorescent light) that would result in aging. Operating temperatures do not exceed 140°F. HDPE components in a plant indoor air environment have no aging effects requiring aging management.

~~4~~3 This TLAA is applicable to the high-density polyethylene (HDPE) piping. Section 4.7.7 describes the evaluation of this TLAA for the replacement ESW piping.

~~5~~4 Open-Cycle Cooling Water System program (B2.1.10) is used instead of Flow-Accelerated Corrosion program (B2.1.7) to manage wall thinning due to erosion of carbon steel piping exposed to rawwater.

5 The Open-Cycle Cooling Water System program (B2.1.10) is used to monitor for recurring internal corrosion in the ESW system. See Further Evaluation 3.3.2.2.8.

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Changes made to add LR-ISG-2012-02 aging evaluation lines for identification of components with internal coatings and evaluation of nonsafety-related components, not covered by NRC GL 89-13.

Table 3.3.2-5 (Pages 3.3-100 through 3.3-104) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-5 Auxiliary Systems – Summary of Aging Management Evaluation – Service Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS, PB, SIA	Carbon Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	~~E, 1~~ B
Piping	LBS, PB, SIA	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	~~E, 1~~ B
Pump	PB	Cast Iron (Gray Cast Iron)	Raw Water (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	E, 3

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Pump	PB	Cast Iron (Gray Cast Iron)	Raw Water (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	E, 3
Strainer	PB	Carbon Steel (with coating or lining)	Plant Indoor Air (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.I.A-77	3.3.1.078	A
Strainer	PB	Carbon Steel (with coating or lining)	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	VII.C1.AP-194	3.3.1.037	E, 1
Thermowell	PB	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	~~E, 1~~ B
Tubing	PB	Carbon Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	~~E, 1~~ B
Tubing	PB	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	~~E, 1~~ B

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve	LBS, PB, SIA	Carbon Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	~~E, 1~~ B
Valve	PB	Cast Iron (Gray Cast Iron)	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	~~E, 1~~ B
Valve	PB	Copper Alloy	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	~~E, 1~~ B
Valve	PB	Ductile Iron	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	~~E, 1~~ B
Valve	LBS, PB, SIA	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	~~E, 1~~ B

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Changes made to add LR-ISG-2012-02 aging evaluation lines for identification of components with internal coatings and revise AMR references.

Table 3.3.2-7 (Pages 3.3-108 through 3.3-112) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-7 Auxiliary Systems – Summary of Aging Management Evaluation – Component Cooling Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
<u>Heat Exchanger (CCW Heat Exchanger)</u>	<u>PB</u>	<u>Carbon Steel (with coating or lining)</u>	<u>Closed Cycle Cooling Water (Ext)</u>	<u>Loss of material</u>	<u>Closed Treated Water Systems (B2.1.11)</u>	<u>VII.C2.AP-202</u>	<u>3.3.1.045</u>	<u>A</u>
Heat Exchanger (CCW Heat Exchanger)	PB	<u>Carbon Steel</u> <u>(with coating or lining)</u>	Raw Water (Int)	Loss of material	Open-Cycle Cooling Water System (B2.1.10)	~~VII.C1-AP-183~~ <u>VII.C1.AP-194</u>	~~3.3.1.038~~ <u>3.3.1.037</u>	<u>A</u>
Piping	LBS, PB, SIA	Carbon Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VIII.G.A-23~~ <u>VIII.B1.SP-60</u>	~~3.3.1.089~~ <u>3.4.1.037</u>	<u>B</u>
Tank	LBS, PB, SIA	Carbon Steel	Condensation (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VIII.G.A-23~~ <u>VIII.B1.SP-60</u>	~~3.3.1.089~~ <u>3.4.1.037</u>	~~D~~ <u>B</u>

Notes for Table 3.3.2-7:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

Plant Specific Notes:

None

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Changes made to add LR-ISG-2012-02 aging evaluation lines for identification of corrosion under insulation, revised the aging evaluation for calcium silicate insulation, and revised the aging evaluation of non-safety related components not covered by NRC GL 89-13.

Table 3.3.2-10 (Pages 3.3-131, 3.3-137 through 3.3-139, 3.3-146, 3.3-147) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-10 Auxiliary Systems – Summary of Aging Management Evaluation – Chemical and Volume Control System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat Exchanger (CVCS Excess Letdown)	PB	Carbon Steel	Closed Cycle Cooling Water (Int)	Cumulative fatigue damage	Time-Limited Aging Analysis evaluated for the period of extended operation	None	None	~~H, 4~~ <u>H, 2</u>
Heat Exchanger (CVCS Letdown)	PB	Carbon Steel	Closed Cycle Cooling Water (Int)	Cumulative fatigue damage	Time-Limited Aging Analysis evaluated for the period of extended operation	None	None	~~H, 4~~ <u>H, 2</u>
Heat Exchanger (CVCS Letdown)	PB	Stainless Steel	Treated Borated Water (Int)	Cracking	Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)	VII.E1.A-69	3.3.1.003	~~E-2~~ <u>E, 1</u>
Insulation	INS	Insulation Calcium Silicate	Plant Indoor Air (Ext)	~~None~~ <u>Reduced thermal insulation resistance</u>	~~None~~ <u>External Surfaces Monitoring of Mechanical Components</u>	~~None~~ <u>VIII.I.S-403</u>	~~None~~ <u>3.4.1.064</u>	~~J, 1~~ <u>A</u>

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
					(B2.1.21)			
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.E1.A-405	3.3.1.132	A
Piping	LBS, SIA	Stainless Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.E1.A-405	3.3.1.132	A
Piping	LBS, SIA	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	~~E-1~~ B
Piping	LBS, SIA	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	VII.C1.A-409a	3.3.1.134	B
Valve	LBS, SIA	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	~~E-1~~ B

Notes for Table 3.3.2-10:

Standard Notes:

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

Plant Specific Notes:
~~1 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.23) is used instead of the Open Cycle Cooling Water program (B2.1.10) to manage the aging of the internal surfaces of stainless steel components exposed to raw water.~~
~~2~~1 The One-Time Inspection program (B2.1.18) is used to verify the effectiveness of the Water Chemistry program (B2.1.2) to manage these aging effects.
~~3. Based on plant operating experience, there are no aging effects requiring management for calcium silicate insulation in a metal jacket in a plant indoor air environment. The insulation does not experience aging effects unless exposed to temperatures, radiation, or chemicals capable of attacking the specific chemical composition of the insulation. The insulation is contained in metal jacket with a vapor barrier to prevent moisture intrusion and is in a non-aggressive air environment that does not experience significant aging effects.~~
~~4~~2 These TLAAs are applicable to the Class 2 Heat Exchangers. Section 4.3.8 describes the evaluation of these TLAAs.

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Changes made to add LR-ISG-2012-02 aging evaluation lines for insulated piping, revise the standard note non-safety related components in a raw water environment, and identification of components with internal coatings

Table 3.3.2-11 (Pages 3.3-149, 3.3-153 through 3.3-158, and 3.3-160) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-11 Auxiliary Systems – Summary of Aging Management Evaluation – Control Building HVAC

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Damper	FB	Carbon Steel (Galvanized)	Ventilation Atmosphere (Int)	Loss of material	Fire Protection (B2.1.13)	VII.F1.A-08	3.3.1.090	~~E, 4~~ <u>E, 3</u>
Damper	PB	Carbon Steel (Galvanized)	Ventilation Atmosphere (Int)	Loss of material	Fire Protection (B2.1.13)	VII.F1.A-08	3.3.1.090	~~E, 4~~ <u>E, 3</u>
Heat Exchanger (Control Building HVAC)	HT	Aluminum	Ventilation Atmosphere (Ext)	Reduction of heat transfer	Open-Cycle Cooling Water System (B2.1.10)	None	None	~~H, 5~~ <u>H, 4</u>
Heat Exchanger (Control Building HVAC)	HT	Aluminum	Ventilation Atmosphere (Ext)	Loss of material	Open-Cycle Cooling Water System (B2.1.10)	VII.F1.AP-142	3.3.1.092	~~E, 6~~ <u>E, 5</u>
<u>Heat Exchanger (Control Building HVAC)</u>	<u>PB</u>	<u>Carbon Steel (with coating or lining)</u>	<u>Dry Gas (Ext)</u>	<u>None</u>	<u>None</u>	<u>VII.J.AP-6</u>	<u>3.3.1.121</u>	<u>A</u>

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat Exchanger (Control Building HVAC)	PB	Carbon Steel (with coating or lining)	Raw Water (Int)	Loss of material	Open-Cycle Cooling Water System (B2.1.10)	VII.C1.AP-194	3.3.1.037	A
Heat Exchanger (Control Building HVAC)	HT, PB	Copper Alloy	Ventilation Atmosphere (Ext)	Reduction of heat transfer	Open-Cycle Cooling Water System (B2.1.10)	None	None	~~H, 5~~ H, 4
Heat Exchanger (Control Building HVAC)	PB	Copper Alloy	Ventilation Atmosphere (Ext)	Loss of material	Open-Cycle Cooling Water System (B2.1.10)	VII.F1.AP-109	3.3.1.079	~~E, 6~~ E, 5
Heat Exchanger (Control Building HVAC)	HT	Copper Alloy	Ventilation Atmosphere (Ext)	Loss of material	Open-Cycle Cooling Water System (B2.1.10)	VII.F1.AP-109	3.3.1.079	~~E, 6~~ E, 5
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.F1.A-405	3.3.1.132	A
Piping	LBS	Carbon Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.AP-194~~ VII.C1.A-408a	~~3.3.1.037~~ 3.3.1.134	~~E, 2~~ B
Piping	PB	Copper Alloy	Plant Indoor Air (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.F1.AP-109	3.3.1.079	~~A, 3~~ A, 2

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	PB	Stainless Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.F1.A-405	3.3.1.132	A
Piping	LBS, SIA	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	B
Solenoid Valve	PB	Copper Alloy	Plant Indoor Air (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.F1.AP-109	3.3.1.079	~~A, 3~~ A, 2
Tubing	LBS, PB	Stainless Steel	Raw Water (Int)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)	~~VII.C1.A-54~~ VII.C1.A-409a	~~3.3.1.040~~ 3.3.1.134	~~E, 2~~ B
Valve	PB, SIA	Copper Alloy	Plant Indoor Air (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.F1.AP-109	3.3.1.079	~~A, 3~~ A, 2

Notes for Table 3.3.2-11:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

Notes for Table 3.3.2-11: (continued)

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

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

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

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

Plant Specific Notes:

1 The subject component is enclosed within another component. Loss of material on the external surface of the subject component is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.23).

~~2 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.23) is used instead of the Open-Cycle Cooling Water program since these components are nonsafety-related drains.~~

~~3~~2 Component is refrigeration piping which is expected to experience condensation during times of elevated humidity on the external surface.

~~4~~3 Fire Protection (B2.1.13) manages the aging effects associated with this fire damper material and environment combination.

~~5~~4 Reduction of heat transfer of the air-side of safety-related air-to-water heat exchangers is managed by the Open-Cycle Cooling Water System program (B2.1.10) consistent with Callaway commitments to GL 89-13.

~~6~~5 Loss of material of the air-side of safety-related air-to-water heat exchangers is managed by Open-Cycle Cooling Water System program (B2.1.10) consistent with Callaway commitments to GL 89-13.

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Changes made to add LR-ISG-2012-02 aging evaluation lines for identification of components with the potential for corrosion under insulation.

Table 3.3.2-13 (Pages 3.3-168) is revised as follows (new text underlined):

Table 3.3.2-13 Auxiliary Systems – Summary of Aging Management Evaluation – Auxiliary Building HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.F2.A-405	3.3.1.132	A

Table 3.3.2-14 (Pages 3.3-177) is revised as follows (new text underlined):

Table 3.3.2-14 Auxiliary Systems – Summary of Aging Management Evaluation – Fuel Building HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.I.A-405	3.3.1.132	A

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Changes made to add LR-ISG-2012-02 aging evaluation lines for identification of components with the potential for corrosion under insulation.

Table 3.3.2-15 (Pages 3.3-186) is revised as follows (new text underlined):

Table 3.3.2-15 Auxiliary Systems – Summary of Aging Management Evaluation – Miscellaneous Buildings HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.I.A-405	3.3.1.132	A

Table 3.3.2-19 (Pages 3.3-201) is revised as follows (new text underlined):

Table 3.3.2-19 Auxiliary Systems – Summary of Aging Management Evaluation – Containment Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	PB	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.F3.A-405	3.3.1.132	A

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Changes made to add LR-ISG-2012-02 aging evaluation lines for Fire Water System AMP, and Aboveground Metallic Tanks AMP.

Table 3.3.2-20 (Pages 3.3-204, and 3.3-216) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-20 Auxiliary Systems – Summary of Aging Management Evaluation – Fire Protection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Filter	PB	Carbon Steel	Condensation (Int)	Loss of material and flow blockage	~~External Surfaces Monitoring of Mechanical Components (B2.1.21)~~ Fire Water System (B2.1.14)	~~VII.G.A-23~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	B
Filter	PB	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	B
Flexible Hoses	PB	Stainless Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-55	3.3.1.066	B
Flow Element	PB	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	B
Flow Orifice	PB	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	B

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Flow Orifice	PB	Stainless Steel	Raw Water (Ext)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-55	3.3.1.066	B
Flow Orifice	PB	Stainless Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-55	3.3.1.066	B
Heat Exchanger (DFP Jacket Water)	PB	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	B
Heat Exchanger (DFP Jacket Water)	PB	Copper Alloy	Raw Water (Ext)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.AP-197	3.3.1.064	B
Hose Station	PB	Copper Alloy	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.AP-197	3.3.1.064	B
Piping	PB	Carbon Steel	Condensation (Int)	Loss of material and flow blockage	~~External Surfaces Monitoring of Mechanical Components (B2.1.21)~~ Fire Water System (B2.1.14)	~~VII.G.A-23~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	~~B~~ D
Piping	PB, SIA	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	~~B~~ D
Piping	PB	Carbon Steel (Galvanized)	Condensation (Int)	Loss of material and flow blockage	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~ Fire Water System (B2.1.14)	~~VII.G.A-23~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	~~B~~ D

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	PB	Carbon Steel (Galvanized)	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	B
Piping	PB	Copper Alloy	Condensation (Int)	Loss of material and flow blockage	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~ Fire Water System (B2.1.14)	~~VII.G.AP-143~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	B
Piping	PB, SIA	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	B
Piping	PB, SIA	Copper Alloy	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.AP-197	3.3.1.064	B
Spray Nozzle	SP	Copper Alloy	Atmosphere/ Weather (Ext)	Loss of material and flow blockage	~~External Surfaces Monitoring of Mechanical Components (B2.1.21)~~ Fire Water System (B2.1.14)	~~VII.I.AP-159~~ VII.G.A-403	~~3.3.1.081~~ 3.3.1.130	B
Spray Nozzle	SP	Copper Alloy	Condensation (Int)	Loss of material and flow blockage	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~ Fire Water System (B2.1.14)	~~VII.G.AP-143~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	B
Spray Nozzle	SP	Copper Alloy	Plant Indoor Air (Ext)	~~None~~ Loss of material and flow blockage	~~None~~ Fire Water System (B2.1.14)	~~VII.J.AP-144~~ VII.G.A-403	~~3.3.1.114~~ 3.3.1.130	~~A~~ B

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Spray Nozzle	SP	Copper Alloy	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.AP-197	3.1.064	B
Tank	PB	Carbon Steel	Atmosphere/ Weather (Ext)	Loss of material and cracking	~~Aboveground Metallic Tanks (B2.1.15)~~ Fire Water System (B2.1.14)	~~VII.H1.A-95~~ VII.G.A-412	~~3.3.1.067~~ 3.3.1.136	~~A~~ B
Tank	PB	Carbon Steel	Condensation (Int)	Loss of material and flow blockage	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~ Fire Water System (B2.1.14)	~~VII.G.A-23~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	D
Tank	PB	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	~~B~~ D
Tank	PB	Carbon Steel (with coating or lining)	Raw Water (Int)	Loss of material	Fire Water System (B2.1.14)	VII.H2.AP-194	3.3.1.037	E, 4
Tubing	PB	Copper Alloy	Condensation (Int)	Loss of material and flow blockage	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~ Fire Water	~~VII.G.AP-143~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	B
Tubing	PB	Copper Alloy	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.AP-197	3.3.1.064	B

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve	PB	Carbon Steel	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.A-33	3.3.1.064	B
Valve	PB	Copper Alloy	Condensation (Int)	Loss of material and flow blockage	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~ Fire Water System B2.1.14)	~~VII.G.AP-143~~ VII.G.A-404	~~3.3.1.089~~ 3.3.1.131	B
Valve	PB, SIA	Copper Alloy	Raw Water (Int)	Loss of material and flow blockage	Fire Water System (B2.1.14)	VII.G.AP-197	3.3.1.064	B

Notes for Table 3.3.2-20:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

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

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

Plant Specific Notes:

1 The fire water storage tanks rest on a sand cushion surrounded by a reinforced concrete ring beam.

Notes for Table 3.3.2-20: (continued)

2 PVC in a wastewater environment is unaffected by water, concentrated alkalies, nonoxidizing acids, oils, ozone, or humidity changes. PVC in a waste water environment is not exposed to direct sunlight or ionizing radiation. Therefore PVC in a wastewater environment has no aging effect.

3 The external surface of these pumps components will be managed by the External Surfaces Monitoring of Mechanical Components program (B2.1.21).

4 The Fire Water System (B2.1.14) program is used to manage components in the fire water system.

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Changes made to identify that inspections of the fuel oil storage tank coatings are inspected by the Fuel Oil Chemistry program (B2.1.16).

Table 3.3.2-21 (Pages 3.3-219 and 3.3-220) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-21 Auxiliary Systems – Summary of Aging Management Evaluation – Emergency Diesel Engine Fuel Oil Storage and Transfer System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Tank	PB	Carbon Steel	Fuel Oil (Int)	Loss of material	Fuel Oil Chemistry (B2.1.16) and One-Time Inspection (B2.1.18)	VII.H1.AP-105	3.3.1.070	A, 2

Notes for Table 3.3.2-21:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

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

Notes for Table 3.3.2-21: (continued)

Plant Specific Notes:

1. Loss of preload for underground bolting is managed by the Bolting Integrity program (B2.1.8).
2. The internal surface of this tank is coated, and the aging effect includes flow blockage due to degradation of the coating. Inspections of the internal surface of the tank performed under the Fuel Oil Chemistry program (B2.1.16) include inspections of the coating.

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Changes made to revise the aging evaluation for calcium silicate insulation based on LR-ISG-2012-02 changes.

Table 3.3.2-22 (Pages 3.3-228) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-22 Auxiliary Systems – Summary of Aging Management Evaluation – Standby Diesel Generator Engine System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	PB	Carbon Steel	Diesel Exhaust (Int)	Cumulative fatigue damage	Time-Limited Aging Analysis evaluated for the period of extended operation	None	None	~~H, 2~~ H, 1
Insulation	INS	Insulation Calcium Silicate	Plant Indoor Air (Ext)	~~None~~ Reduced thermal insulation resistance	~~None~~ External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~None~~ VIII.I.S-403	~~None~~ 3.4.1.064	~~J, 1~~ A

Notes for Table 3.3.2-22:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

Notes for Table 3.3.2-22: (continued)

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

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

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

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

Plant Specific Notes:

~~1 Based on plant operating experience, there are no aging effects requiring management for calcium silicate insulation in a metal jacket in a plant indoor air environment. The insulation does not experience aging effects unless exposed to temperatures, radiation, or chemicals capable of attacking the specific chemical composition of the insulation. The insulation is contained in metal jacket with a vapor barrier to prevent moisture intrusion and is in a non-aggressive air environment that does not experience significant aging effects.~~

~~2~~1 This TLAA is applicable to the standby diesel generator engine exhaust piping. Section 4.3.5 describes the evaluation of this TLAA.

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Changes made to revise the aging evaluation for submerged grey iron and stainless steel pumps in a waste water environment based on LR-ISG-2012-02 changes

Table 3.3.2-26 (Pages 3.3-259, 3.3-260, and 3.3-262) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-26 Auxiliary Systems – Summary of Aging Management Evaluation – Oily Waste System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Closure Bolting	LBS, PB	Carbon Steel	Waste Water (Ext)	Loss of preload	Bolting Integrity (B2.1.8)	None	None	~~G, 4~~ G, 2
Closure Bolting	LBS	Stainless Steel	Waste Water (Ext)	Loss of preload	Bolting Integrity (B2.1.8)	None	None	~~G, 4~~ G, 2
Pump	LBS, PB	Cast Iron (Gray Cast Iron)	Waste Water (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.E5.AP-281~~ VII.E5.A-410	~~3.3.1.091~~ 3.3.1.135	~~E, 1~~ A
Pump	LBS, PB	Cast Iron (Gray Cast Iron)	Waste Water (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.E5.AP-281~~ VII.E5.A-410	~~3.3.1.091~~ 3.3.1.135	~~E, 1~~ A
Pump	LBS, PB	Cast Iron(Gray Cast Iron)	Waste Water (Ext)	Loss of material	Selective Leaching (B2.1.19)	~~None~~ VII.E5.A-407a	~~None~~ 3.3.1.072	~~G, 3~~ B

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Pump	LBS, PB	Cast Iron(Gray Cast Iron)	Waste Water (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.E5.AP-281~~ VII.E5.A-410	~~3.3.1.091~~ 3.3.1.135	~~E, 1~~ A
Pump	LBS, PB	Cast Iron(Gray Cast Iron)	Waste Water (Int)	Loss of material	Selective Leaching (B2.1.19)	~~None~~ VII.E5.A-407a	~~None~~ 3.3.1-072	~~G, 3~~ B
Pump	LBS	Stainless Steel	Waste Water (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.E5.AP-278~~ VII.E5.A-411	~~3.3.1.095~~ 3.3.1.072	~~E, 1~~ A
Pump	LBS	Stainless Steel	Waste Water (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.E5.AP-278~~ VII.E5.A-411	~~3.3.1.095~~ 3.3.1.072	~~E, 1~~ A
Valve	LBS, PB	Cast Iron(Gray Cast Iron)	Waste Water (Int)	Loss of material	Selective Leaching (B2.1.19)	~~None~~ VII.E5.A-407a	~~None~~ 3.3.1.072	~~G, 3~~ B

Notes for Table 3.3.2-26:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

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

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

Plant Specific Notes:

1 The External Surfaces Monitoring of Mechanical Components program (B2.1.21) is credited since the component's external surface is exposed to waste water.

~~2 Since the internal and external environments for this component are the same, the External Surfaces Monitoring of Mechanical Components program (B2.1.21) is credited to manage the aging of the internal surfaces of this component.~~

~~3 Gray Cast Iron SSCs with surfaces exposed to Waste Water are subject to loss of material due to selective leaching.~~

~~4~~2 Loss of preload for submerged bolting associated with submerged pumps is managed by the Bolting Integrity program (B2.1.8).

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Changes made to revise the aging evaluation for submerged stainless steel pumps in a waste water environment based on LR-ISG-2012-02 changes

Table 3.3.2-27 (Pages 3.3-267) is revised as follows (new text underlined and deleted text shown in strikethrough):

Table 3.3.2-27 Auxiliary Systems – Summary of Aging Management Evaluation – Floor and Equipment Drainage System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Pump	LBS, SIA	Stainless Steel	Waste Water (Ext)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.E5.AP-278~~ VII.E5.A-411	~~3.3.1.095~~ 3.3.1.135	~~E, 1~~ A
Pump	LBS, SIA	Stainless Steel	Waste Water (Int)	Loss of material	External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~VII.E5.AP-278~~ VII.E5.A-411	~~3.3.1.095~~ 3.3.1.135	~~E, 1~~ A

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Changes made to add LR-ISG-2012-02 aging evaluation lines for identification of components with the potential for corrosion under insulation.

Table 3.3.2-28 (Pages 3.3-273 and 3.3-275) is revised as follows (new text underlined):

Table 3.3.2-28 Auxiliary Systems – Summary of Aging Management Evaluation – Miscellaneous Systems in Scope for Criterion 10 CFR 54.4.(a)(2) – Central Chilled Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.I.A-405	3.3.1.132	A

Table 3.3.2-28 Auxiliary Systems – Summary of Aging Management Evaluation – Miscellaneous Systems in Scope for Criterion 10 CFR 54.4.(a)(2) – Domestic Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	LBS	Copper Alloy	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VII.I.A-405	3.3.1.132	A

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Changes made to Section 3.4.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs (AMPs), as a result of LR-ISG-2012-02 changes.

Section 3.4.2.1 in Chapter V of NUREG-1801 for Steam and Power Conversion System, (Page 3.4-2 thru 3.4-9) is revised to add the materials, environments, aging effects requiring management and (AMPs) to the sections indicated.

3.4.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs (AMPs)

Loss of Material and Cracking	
3.4.2.1.2	Main Steam Supply System
3.4.2.1.3	Main Feedwater System
3.4.2.1.6	Condensate Storage and Transfer System
Reduced Thermal Insulation Resistance	
3.4.2.1.2	Main Steam Supply System
3.4.2.1.3	Main Feedwater System
3.4.2.1.5	Auxiliary Feedwater System
3.4.2.1.6	Condensate Storage and Transfer System

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Add a new section for the further evaluation for loss of material due to recurring internal corrosion.

Further Evaluation 3.4.2.2.6 (Page 3.4-10) is added as follows (new text shown underlined):

3.4.2.2.6 Loss of Material Due to Recurring Internal Corrosion

Operating experience associated with Steam and Power Conversion System and associated aging management programs does not meet the threshold for significance of aging effect or frequency of occurrence of the aging effect to be considered as recurring internal corrosion.

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Changes made to incorporate LR-ISG-2012-02 changes for aboveground metallic tanks and corrosion under insulation,

Table 3.4-1, Summary of Aging Management Programs in Chapter VIII of NUREG-1801 for Steam and Power Conversion System, (Page 3.4-15, 3.4-16, 3.4-21, 3.4-22, and 3.4-31) is revised as follows (deleted text shown in strikethrough and new text shown underlined):

Table 3.4-1 Summary of Aging Management Programs in Chapter VIII of NUREG-1801 for Steam and Power Conversion System

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1.012	Steel; stainless steel Tanks exposed to Treated water	Loss of material due to general (steel only), pitting, and crevice corrosion	Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)	No	~~Consistent with NUREG-1801.~~ <u>Not applicable. Callaway has no in-scope steel or stainless steel tanks less than 100,000 gallons exposed to treated water in the steam and power conversion systems, so the applicable NUREG-1801 lines were not used.</u>
3.4.1.015	Steel Heat exchanger components exposed to Treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)	No	~~Consistent with NUREG-1801.~~ <u>Not applicable. Callaway has no in-scope steel heat exchanger in the steam and power conversion systems, so the applicable NUREG-1801 lines were not used.</u>

Table 3.4-1 Summary of Aging Management Programs in Chapter VIII of NUREG-1801 for Steam and Power Conversion System

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1.030	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)	Aboveground Metallic Tanks (B2.1.15)	No	Consistent with NUREG-1801 ~~with aging management program exceptions~~. ~~The aging management program(s) with exceptions to NUREG-1801 include: Aboveground Metallic Tanks (B2.1.15)~~
3.4.1.031	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	Aboveground Metallic Tanks (B2.1.15)	No	Consistent with NUREG-1801 ~~with aging management program exceptions~~. ~~The aging management program(s) with exceptions to NUREG-1801 include: Aboveground Metallic Tanks (B2.1.15).~~

Table 3.4-1 Summary of Aging Management Programs in Chapter VIII of NUREG-1801 for Steam and Power Conversion System

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.061	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 (See subsection 3.4.2.2.6)	Not applicable. Callaway has no in-scope components subject to recurring internal corrosion in the steam and power conversion systems, so the applicable NUREG-1801 lines were not used.
3.4.062	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	Aboveground Metallic Tanks (B2.1.15)	No	Consistent with NUREG-1801.
3.4.063	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)	External Surfaces Monitoring of Mechanical Components (B2.1.21) or Aboveground Metallic Tanks (B2.1.15) (for tanks only)	No	Consistent with NUREG-1801.

Table 3.4-1 Summary of Aging Management Programs in Chapter VIII of NUREG-1801 for Steam and Power Conversion System

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.064	Jacketed calcium silicate or fiberglass insulation in an air-indoor uncontrolled or air-outdoor environment	Reduced thermal insulation resistance due to moisture intrusion	External Surfaces Monitoring of Mechanical Components (B2.1.21)	No	Consistent with NUREG-1801
3.4.065	Jacketed foamglas (glass dust) insulation in an air-indoor uncontrolled or air-outdoor environment	Reduced thermal insulation resistance due to moisture intrusion	External Surfaces Monitoring of Mechanical Components (B2.1.21)	No	Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program Aboveground Metallic Tanks (B2.1.15) is credited.

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Changes made to add LR-ISG-2012-02 aging evaluation lines for insulated piping and revise the aging evaluation for calcium silicate insulation.

Table 3.4.2-2 (Pages 3.4-34 and 3.3-40) is revised as follows (deleted text shown in strikethrough and new text shown underlined):

Table 3.4.2-2 Steam and Power Conversion System – Summary of Aging Management Evaluation – Main Steam Supply System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Insulation	INS	Insulation Calcium Silicate	Plant Indoor Air (Ext)	~~None~~ <u>Reduced thermal insulation resistance</u>	~~None~~ <u>External Surfaces Monitoring of Mechanical Components (B2.1.21)</u>	~~None~~ <u>VIII.I.S-403</u>	~~None~~ <u>3.4.1.064</u>	~~J, 2~~ A
<u>Piping</u>	<u>LBS, SIA</u>	<u>Carbon Steel</u>	<u>Condensation (Ext)</u>	<u>Loss of material and cracking</u>	<u>External Surfaces Monitoring of Mechanical Components (B2.1.21)</u>	<u>VIII.B1.S-402</u>	<u>3.4.1.063</u>	<u>A</u>

Notes for Table 3.4.2-2:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

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

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

Plant Specific Notes:

1 NUREG-1801, Section XI.M24 Compressed Air Monitoring applies to monitoring the piping and components associated with the air compressors and dryers. Air compressor and dryer piping and components are not within the scope of license renewal for Callaway. In-scope piping and components are associated with containment penetrations and nitrogen gas piping and components for backup closure of valves. The AMP M38 Internal Surfaces in Miscellaneous Piping and Ducting Components requires internal inspections consistent with the AMP M24 Compressed Air Monitoring. Therefore, for components associated with the compressed air system, the AMP M38 Internal Surfaces in Miscellaneous Piping and Ducting Components is credited rather than M24 Compressed Air Monitoring.

~~2 Based on plant operating experience, there are no aging effects requiring management for calcium silicate insulation in a metal jacket in a plant indoor air environment. The insulation does not experience aging effects unless exposed to temperatures, radiation, or chemicals capable of attacking the specific chemical composition of the insulation. The insulation is contained in metal jacket with a vapor barrier to prevent moisture intrusion and is in a non-aggressive air environment that does not experience significant aging effects.~~

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Changes made to add LR-ISG-2012-02 aging evaluation lines for insulated piping and revise the aging evaluation for calcium silicate insulation.

Table 3.4.2-3 (Pages 3.4-42, and 3.4-46) is revised as follows (deleted text shown in strikethrough and new text shown underlined):

Table 3.4.2-3 Steam and Power Conversion System – Summary of Aging Management Evaluation – Main Feedwater System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Insulation	INS	Insulation Calcium Silicate	Plant Indoor Air (Ext)	~~None~~ Reduced thermal insulation resistance	~~None~~ External Surfaces Monitoring of Mechanical Components (B2.1.21)	~~None~~ VIII.I.S-403	~~None~~ 3.4.1.064	~~J, 1~~ A
Piping	LBS	Carbon Steel	Condensation (Ext)	Loss of material and cracking	External Surfaces Monitoring of Mechanical Components (B2.1.21)	VIII.D1.S-402	3.4.1.063	A

Notes for Table 3.4.2-3:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

Plant Specific Notes:

None

~~1 Based on plant operating experience, there are no aging effects requiring management for calcium silicate insulation in a metal jacket in a plant indoor air environment. The insulation does not experience aging effects unless exposed to temperatures, radiation, or chemicals capable of attacking the specific chemical composition of the insulation. The insulation is contained in metal jacket with a vapor barrier to prevent moisture intrusion and is in a non-aggressive air environment that does not experience significant aging effects.~~

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Changes made to add LR-ISG-2012-02 aging evaluation lines to revise the aging evaluation for calcium silicate insulation.

Table 3.4.2-5 (Pages 3.4-54 and 3.4-60) is revised as follows (deleted text shown in strikethrough and new text shown underlined):

Table 3.4.2-5 Steam and Power Conversion System – Summary of Aging Management Evaluation – Auxiliary Feedwater System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Insulation	INS	Insulation Calcium Silicate	Plant Indoor Air (Ext)	~~None~~ <u>Reduced thermal insulation resistance</u>	~~None~~ <u>External Surfaces Monitoring of Mechanical Components (B2.1.21)</u>	~~None~~ <u>VIII.I.S-403</u>	~~None~~ <u>3.4.1.064</u>	~~J, 1~~ A

Notes for Table 3.4.2-5:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

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

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

Plant Specific Notes:

None

~~1 Based on plant operating experience, there are no aging effects requiring management for calcium silicate insulation in a metal jacket in a plant indoor air environment. The insulation does not experience aging effects unless exposed to temperatures, radiation, or chemicals capable of attacking the specific chemical composition of the insulation. The insulation is contained in metal jacket with a vapor barrier to prevent moisture intrusion and is in a non-aggressive air environment that does not experience significant aging effects.~~

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Changes made to add LR-ISG-2012-02 aging evaluation lines for insulated piping and revise the aging evaluation for aboveground metallic tanks and calcium silicate insulation.

Table 3.4.2-6 (Pages 3.4-62, 3.4-63, and 3.3-65) is revised as follows (deleted text shown in strikethrough and new text shown underlined):

Table 3.4.2-6 Steam and Power Conversion System – Summary of Aging Management Evaluation – Condensate Storage and Transfer System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Insulation	INS	Acrylic/Urethane	Atmosphere/ Weather (Ext)	Cracking, blistering, change in color	Aboveground Metallic Tanks (B2.1.15)	None	None	J, ~~3~~ <u>1</u>
Insulation	INS	Insulation Foamglas (glass dust)	Atmosphere/ Weather (External)	~~None~~ <u>Reduced thermal insulation resistance</u>	~~None~~ <u>Aboveground Metallic Tanks (B2.1.15)</u>	~~None~~ <u>VIII.I.S-404</u>	~~None~~ <u>3.4.1.065</u>	~~J, 2~~ E,2
<u>Piping</u>	<u>PB</u>	<u>Carbon Steel</u>	<u>Condensation (Ext)</u>	<u>Loss of material and cracking</u>	<u>External Surfaces Monitoring of Mechanical Components (B2.1.21)</u>	<u>VIII.H.S-402</u>	<u>3.4.1.063</u>	<u>A</u>

Table 3.4.2-6 Steam and Power Conversion System – Summary of Aging Management Evaluation – Condensate Storage and Transfer System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Tank	PB	Stainless Steel	Atmosphere/ Weather (Ext)	~~Cracking~~ Loss of material and Cracking	Aboveground Metallic Tanks (B2.1.15)	~~VIII.G.SP-118~~ VIII.E.SP-138	~~3.4.1.002~~ 3.4.1.030	~~E, 1~~ A
~~Tank~~	~~PB~~	~~Stainless Steel~~	~~Atmosphere/ Weather (Ext)~~	~~Loss of material~~	~~Aboveground Metallic Tanks (B2.1.15)~~	~~VIII.G.SP-127~~	~~3.4.1.003~~	~~E, 1~~
Tank	PB	Stainless Steel	Concrete (Ext)	Loss of material and Cracking	Aboveground Metallic Tanks (B2.1.15)	VIII.E.SP-137	3.4.1.031	~~B~~ A
~~Tank~~	~~PB~~	~~Stainless Steel~~	~~Condensation (Int)~~	~~Loss of material~~	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B2.1.23)~~	~~V.D1.EP-81~~	~~3.2.1.048~~	~~D~~
Tank	PB	Stainless Steel	Secondary Water (Int)	Loss of material	~~Water Chemistry (B2.1.2) and One-Time Inspection (B2.1.18)~~ Aboveground Metallic Tanks (B2.1.15)	~~VIII.G.SP-75~~ VIII.E.S-405	~~3.4.1.012~~ 3.4.1.062	A

Notes for Table 3.4.2-6:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

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

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

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

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

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

Plant Specific Notes:

~~1 The bottom of this tank rests on a concrete foundation. Therefore the Aboveground Metallic Tanks program (B2.1.15) is credited.~~

~~2 The mechanical properties FOAMGLAS (glass dust) are consistent with other glass materials and is evaluated consistent with other glass-like materials in an atmosphere/weather environment in NUREG-1801.~~

~~3~~1 Acrylic/Urethane in an Atmosphere/Weather (Ext.) environment is subjected to UV radiation, moisture and thermal exposure. The acrylic rubber sealant coating provides UV radiation protection for the urethane foam tank insulation. The dome of the stainless steel tank is prepped with a low halogen (<200 ppm) primer prior to the application of the foam urethane. The Aboveground Metallic Tanks program (B2.1.15) manages cracking blistering or changes in color of the acrylic/urethane insulation. The acrylic rubber sealant is inspected for aging and damage as an indicator for the urethane foam underneath it.

2. The Aboveground Metallic Tanks program (B2.1.15) is used instead of the External Surfaces Monitoring of Mechanical Components program (B2.1.21) to manage Foamglas ® insulation on the condensate storage tank.

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Reactor vessel studs usage factors in the Reactor Pressure Vessel Section of Table 4.3-3 were revised to reflect the results of the license renewal analysis to address the stuck stud. In addition, the accumulator piping usage factor in the Class 1 Piping Section of Table 4.3-3 was revised to reflect the recent modification for the addition of a tie-back support.

Table 4.3-3 Reactor vessel studs usage factors in the Reactor Pressure Vessel Section (Page 4.3-19) and the accumulator piping usage factor in the Class 1 Piping Section (Page 4.3-22) are revised as follows (new text underlined and deleted text shown in strikethrough):

Table 4.3-3 ASME Class 1 Fatigue Analyses Under the Fatigue Monitoring Program

Component	CUF
Reactor Pressure Vessel Components	
Inlet Nozzles Support	0.0795 0.0306
Outlet Nozzles Support	0.1078 0.0205
Head Flanges	0.0155
Vessel Flange	0.0196
Studs Studs Installed in Holes with Damaged Threads	~~0.4780~~<u>0.63</u> ~~0.75~~<u>0.99</u>
CRDM Housing	0.1093
Bottom Head to Shell Junction	0.0070
Bottom-Mounted Instrument Tubes	0.3184
Vessel Wall Transition	0.0105
Core Support Lugs	0.0617
Head Adapter Plug	0.0036

Class 1 Piping	
Pressurizer Surge Line	0.099 Includes the effects of thermal stratification.
Spray/Aux. Spray Loops 1 & 2	0.84
Pressurizer Safety Valve Piping	0.975
Pressurizer Relief Valve Piping	0.970
Hot Leg	0.95
Crossover Leg	0.50
Cold Leg	0.37
Drain Line Loop 2	0.95
Normal Letdown/Drain Line Loop 3	0.95
Drain Line Loop 1	0.01
Excess Letdown/Drain Line Loop 4	0.191
Normal/Alternate Charging - Loops 1 & 4	0.93
Seal Water Injection Loop 1	0.066
Seal Water Injection Loop 2	0.066
Seal Water Injection Loop 3	0.114
Seal Water Injection Loop 4	0.067
RHR Loops 1 & 4 Suction Line	0.296
Loop 1 Hot Leg Safety Injection Line	0.661
Loop 4 Hot Leg Safety Injection Line	0.110
Accumulator Lines - Loops 1, 2, 3, & 4	0.980 0.999 (Loop 4)
SI Hot Leg Loops 2 & 3	0.090
Boron Injection Header	0.773
Boron Injection Header Lines – Loops 1, 2, 3, & 4	0.930

A1.6 PWR VESSEL INTERNALS

The PWR Vessel Internals program relies on implementation of the guidance included in Electric Power Research Institute (EPRI) 1022863 (MRP-227-A), *PWR Internals Inspection and Evaluation Guideline* and EPRI 1016609 (MRP-228), *Inspection Standard for PWR Internals* to manage the aging effects of reactor vessel internal (RVI) components.

This program is used to manage (a) various forms of cracking, including stress corrosion cracking (SCC), primary water stress corrosion cracking (PWSCC), irradiation assisted stress corrosion cracking (IASCC), or cracking due to fatigue/cyclical loading; (b) loss of material induced by wear; (c) loss of fracture toughness due to either thermal aging or neutron irradiation embrittlement; (d) changes in dimension due to void swelling and irradiation growth; and (e) loss of preload due to thermal and irradiation-enhanced stress relaxation or creep.

~~The PWR Vessel Internals program is a new program and will be implemented within 24 months after the issuance of MRP-227-A, *PWR Internals Inspection and Evaluation Guideline.*~~

~~Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.~~

A1.10 OPEN-CYCLE COOLING WATER SYSTEM

The Open-Cycle Cooling Water System program manages loss of material, wall thinning, reduction of heat transfer, cracking, blistering, change in color, and hardening and loss of strength for components within the scope of license renewal and exposed to the raw water of the essential service water system and heat exchangers and other components in other systems serviced by the essential service water system.

The program is consistent with commitments as established in responses to NRC Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Components* and includes:

(a) surveillance and control of biofouling,
(b) tests to verify heat transfer,
(c) routine inspection and maintenance program,
(d) system walkdown inspection, and
(e) review of maintenance, operating, and training practices and procedures.

The Open-Cycle Cooling Water System program includes the essential service water system that transfers heat from the safety-related structures, systems and components to the ultimate heat sink as defined in NRC Generic Letter 89-13. Periodic heat transfer testing or inspection and cleaning of heat exchangers with a heat transfer intended function is performed in accordance with commitments to NRC Generic Letter 89-13 to verify heat transfer capabilities.

In addition, the internal coatings of components within the scope of this program are periodically visually inspected to ensure that loss of coating integrity is detected prior to (1) loss of component intended function, including loss of function due to accelerated degradation caused by localized coating failures, and (2) degradation of downstream component performance due to flow blockage.

A1.14 FIRE WATER SYSTEM

The Fire Water System program manages loss of material and flow blockage for water-based fire protection systems. ~~Consistent with National Fire Protection Association (NFPA) commitments, the program consists of periodic full-flow flush tests and system performance tests to prevent corrosion from biofouling in the fire protection system.~~ This program manages aging effects through the use of flow testing and visual inspections performed consistent with provisions of the 2011 Edition of National Fire Protection Association (NFPA) 25 noted in Table A1.14-1. Unless noted in Table A1.14-1, flow testing and visual inspections are performed at intervals specified in the 2011 Edition of NFPA 25. Testing or replacement of sprinklers that have been in place for 50 years is performed in accordance with the 2011 Edition of NFPA 25.

In addition to NFPA codes and standards, portions of the water-based fire protection system that are: (a) normally dry but periodically subjected to flow (e.g., dry-pipe or preaction sprinkler system components) and (b) cannot be drained or allow water to collect are to be subjected to augmented testing beyond that specified in NFPA 25, including (a) periodic full flow tests at the design pressure and flow rate or internal visual inspections and (b) volumetric wall-thickness examinations.

The water-based fire protection system is normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

~~The Fire Water System program conducts flow tests through each open head spray/sprinkler nozzle to verify water flow is unobstructed. Prior to 50 years in service, the Fire Water System program requires sprinkler heads to be replaced or have representative samples submitted for field-service testing by a recognized testing laboratory in accordance with NFPA 25. The program field-service tests additional representative samples every 10 years thereafter during the period of extended operation to ensure signs of aging are detected in a timely manner.~~

~~Non-intrusive wall thickness examinations are performed on fire water piping to identify loss of material. Wall thickness examinations will be performed on fire water piping every three years. Each three year sample will include at least three locations for a total of 100 feet of above-ground fire water piping and be selected based on system susceptibility to corrosion or fouling and evidence of performance degradation during system flow testing or periodic flushes. The basis for the frequency is that three years is the frequency required by the FSAR for the yard fire loop flush and for the flow tests of the fire water loops. In addition internal~~ Internal visual internal inspections are used when the internal surface of the piping is exposed during plant maintenance. ~~These inspections evaluate (a) wall thickness to ensure against catastrophic failure and (b) the inner diameter of the piping as it applies to the design flow of the fire protection system.~~

Samples are collected for microbiologically-influenced corrosion quarterly and when fire water piping and components are opened for maintenance or are accessible. Biofouling is prevented by periodically adding treatment chemicals such as an anti-scalant, a biopenetrant, and a biostat to the fire water system annually and when monitoring indicates they should be added. The MIC Index is trended to evaluate treatment effectiveness in specific locations.

Inspections of wetted normally dry piping segments that cannot be drained or that allow water to collect begin five years before the period of extended operation. The program's remaining inspections begin during the period of extended operation.

~~The internal coating of the fire water storage tanks will be inspected with a minimum frequency of alternating refueling outages.~~

Table A1.14-1 Fire Water System Aging Management

Component	**NFPA 25 Section**	**Aging Management Performed**
Sprinkler Systems: Sprinkler inspections	5.2.1.1	Sprinklers are inspected for signs of leakage, corrosion, and foreign material.
Sprinkler Systems: Sprinkler testing	5.3.1	Prior to 50 years in service, the Fire Water System program requires sprinkler heads to be replaced or have representative samples submitted for field-service testing by a recognized testing laboratory in accordance with NFPA 25. The program field-service tests additional representative samples every 10 years thereafter during the period of extended operation to ensure signs of aging are detected in a timely manner.
Standpipe and Hose Systems: Flow Tests	6.3.1	Flow testing is conducted at least every five years at the hydraulically most remote hose connections of each zone of an automatic standpipe system to verify the water supply provides the design pressure at the required flow.
Private Fire Service Mains: Underground and Exposed Piping	7.3.1	Underground and exposed piping is flow tested at flows representative of those during a fire to determine the internal condition of the piping at minimum 3-year intervals.
Private Fire Service Mains: Hydrants	7.3.2	Hydrants are flow tested annually to ensure proper functioning.

Component	NFPA 25 Section	Aging Management Performed
Fire Pumps: Suction Screens	8.3.3.7	Not applicable. Callaway's fire protection pumps do not have suction screens.
Water Storage Tanks: Exterior Inspections	9.2.5.5	The exterior painted surface of the fire water storage tanks (FWSTs) is inspected annually for signs of degradation.
Water Storage Tanks: Interior inspections	9.2.6, 9.2.7	The interior of each FWST is inspected every other refueling cycle for signs of aging. Testing of interior surfaces is performed for coating integrity and tank bottom integrity when FWSTs exhibit signs of interior pitting, corrosion, or coating failure.
Valves and System-Wide Testing: Main Drain Test	13.2.5	Main drain tests are not conducted at Callaway. As an alternative, one of the following methods is used to assure the reliable operation of the fire protection water supply system. 1. The fire suppression system is fed from two or more directions such that the failure of one isolation valve will not impair the system and the long runs of pipe are flow tested under other surveillances. OR 2. The flow path from the fire pump to the system control valve is verified on an 18-month frequency, and the following surveillances are performed with acceptable results: • Fire water valve position verification • Fire protection valve cycling • Annual fire protection loop flow test • Fire protection water system flush • Hydrant flush • Post indicator valve testing • Wet pipe, deluge, and preaction system visual inspection
Valves and System-Wide Testing: Deluge Valves	13.4.3.2.2 to 13.4.3.2.5	A full flow test using air or water is performed every refueling outage by trip testing each deluge valve to verify that spray/sprinkler nozzles are unobstructed.

Component	NFPA 25 Section	Aging Management Performed
Water Spray Fixed Systems: Strainers	10.2.1.6, 10.2.1.7, 10.2.7	Spray system strainers are inspected and cleaned every refueling outage and after each system actuation. Callaway does not have main line strainers.
Water Spray Fixed Systems: Operation Test	10.3.4.3	A full flow test is performed every refueling cycle using air or water to verify that spray/sprinkler nozzles are unobstructed.
Foam Water Sprinkler Systems: Strainers	11.2.7.1	Not applicable. Callaway does not have a foam water sprinkler system.
Foam Water Sprinkler Systems: Operational Test Discharge Patterns	11.3.2.6	Not applicable. Callaway does not have a foam water sprinkler system.
Foam Water Sprinkler Systems: Storage tanks	Visual inspection for internal corrosion	Not applicable. Callaway does not have a foam water sprinkler system.
Obstruction Investigation: Obstruction, Internal Inspection of Piping	14.2 and 14.3	The internal surface of piping and branch lines is inspected for foreign material every five years by flushing wet pipe system piping. In buildings having multiple wet pipe systems, every other system is inspected every five years, and the remaining systems are inspected at the next five year interval. If foreign material is found in any system in a building during the five year inspection, then all systems in the building will be inspected. If sufficient foreign material is found to obstruct pipe or sprinklers, then an obstruction investigation is conducted. If the visual inspection detects surface irregularities that could indicate wall loss below nominal pipe wall thickness, then follow-up volumetric examinations will be performed.

A1.15 ABOVEGROUND METALLIC TANKS

The Aboveground Metallic Tanks program manages loss of material and cracking on the external surfaces of aboveground metallic tanks within the scope of license renewal that are supported on concrete ~~or soil~~. The program also manages cracking, blistering, and change in color of the acrylic/urethane insulation on the condensate storage tank (CST). The program applies to the CST~~,~~ and refueling water storage tank (RWST). ~~and the two fire water storage tanks (FWSTs).~~

~~For the carbon steel fire water storage tanks, the program relies on application of paint, coating, or tank bottom edge grout as corrosion preventive measures. In addition, cathodic protection is used as a preventive measure to prevent corrosion on exposed bare metal as-left surfaces of the tanks.~~

This program performs visual inspections during each refueling cycle to monitor for ~~aging of the tank wall and dome external surface paint or~~ damage of the external surface insulation covering. A one-time inspection of twenty-five external surface locations of approximately one square foot in area will be inspected by removing insulation, with at least ten locations near the base of the tank wall and at least two locations on the dome. Removal of the tank insulation permits ~~a sampling~~ visual and surface examinations of the tank external surfaces to ~~be inspected for aging~~ confirm that environmental impacts are not present at sufficient levels to cause pitting corrosion, crevice corrosion or cracking.

One-time volumetric examinations ~~thickness measurements~~ are taken within five years prior to entering the period of extended operation from inside the emptied tanks to determine the thickness of the tank bottom. The entire tank bottom will be scanned to detect loss of material. Thickness measurements will be performed on regions of the tank bottom that indicate a loss of material below nominal plate thickness. The thickness measurements ensure significant loss of material is not occurring, so that the intended function of each tank is maintained during the period of extended operation. A soil sample is taken underneath the CST and RWST and analyzed to demonstrate that the soil is not corrosive The soil sample is performed prior to entering the period of extended operation and during each ten-year period in the period of extended operation.

The chemical treatments of cooling tower water do not contain chemical compounds that could cause cracking, pitting, or crevice corrosion on the external surfaces of the tanks. ~~Within five years of~~ Prior to entering the period of extended operation and during each ten year period in the period of extended operation, a ~~one-time~~ soil surface sample near the CST and RWST will be performed. The soil surface sample and samples of residue on the top and sides of each tank will be evaluated to ensure that chlorides or other aggressive cooling tower water treatment chemicals are not creating an aggressive environment that would degrade the CST, RWST, or their insulation jacketing.

A one-time inspection consistent with the One-Time Inspection program (A1.18) will be performed on the inside surfaces of the CST and RWST shell, roof and bottom.

The Aboveground Metallic Tanks program is a new program that will be implemented within the five year period prior to the period of extended operation.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

A1.21 EXTERNAL SURFACES MONITORING OF MECHANICAL COMPONENTS

The External Surfaces Monitoring of Mechanical Components program manages loss of material and cracking for metallic components and cracking and changes in material properties for cement board components. The program also manages loss of material, cracking, and hardening and loss of strength for polymeric components. Periodic visual inspections of external surfaces conducted through engineering walkdowns will be used to identify loss of material and leakage. A sample of outdoor component surfaces that are insulated and a sample of indoor insulated components exposed to condensation (due to the in-scope component being operated below the dew point), are periodically inspected every 10 years during the period of extended operation. Periodic polymeric inspections will also include manual or physical manipulation in order to verify the absence of cracking, hardening, or loss of strength. Periodic monitoring of stainless steel components will also include visual inspection for cracking when exposed to an air environment containing halides.

The External Surfaces Monitoring of Mechanical Components program is a new program that will be implemented prior to the period of extended operation.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

A1.23 INSPECTION OF INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program manages cracking, loss of material, hardening and loss of strength. The program inspects internal surfaces of metallic piping, piping components, ducting, polymeric components, and other components that are exposed to plant indoor air, ventilation atmosphere, atmosphere/weather, condensation, borated water leakage, diesel exhaust, lubricating oil, and water system environment not managed by Open-Cycle Cooling Water System (A1.10), Closed Treated Water System (A1.11), Fire Water System (A1.14), and Water Chemistry (A1.2) programs.

Internal inspections are normally performed at opportunities where the internal surfaces are made accessible, such as periodic system and component surveillance activities or maintenance activities. Visual inspections of internal surfaces of plant components are performed by qualified personnel. For certain materials, such as polymers, visual inspections will be augmented by physical manipulation or pressurization to detect hardening, loss of strength, and cracking. The program includes inspections to detect material degradation that could result in a loss of component intended function.

If work opportunities are not sufficient to allow inspection of a representative sample of components, supplemental inspections are also performed. A representative sample size is 20 percent of the accessible and inaccessible component population (defined as components having the same material and environment combination) up to a maximum of 25 components. The locations and intervals for supplemental inspections are based on assessments of the likelihood of significant aging effects, derived from current industry and plant-specific operating experience.

Components having the same material-environment combination with repetitive failures due to aging require a plant-specific program, unless the component material has been replaced by a material of more corrosion resistance for the environment of interest.

In addition, the internal coatings of the service water pump strainers are periodically visually inspected to ensure that loss of coating integrity is detected prior to (1) loss of component intended function, including loss of function due to accelerated degradation caused by localized coating failures, and (2) degradation of downstream component performance due to flow blockage.

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new program and will be implemented prior to the period of extended operation.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
4	Implement the PWR Vessel Internals program as described in LRA Section B2.1.6. As part of the implementation activities address the following Applicant/Licensee Action Items (A/LAI) of NRC MRP-227-A Safety Evaluation dated December 16, 2011. (Completed LRA Amendment 28) ~~:~~ Applicant/Licensee Action Item (A/LAI) #1 Each applicant/licensee is responsible for assessing its plant's design and operating history and demonstrating that the approved version of MRP-227 is applicable to the facility. Each applicant/licensee shall refer, in particular, to the assumptions regarding plant design and operating history made in the FMECA and functionality analyses for reactors of their design (i.e., Westinghouse, CE, or B&W) which support MRP-227 and describe the process used for determining plant-specific differences in the design of their RVI components or plant operating conditions, which result in different component inspection categories. The applicant/licensee shall submit this evaluation for NRC review and approval as part of its application to implement the approved version of MRP-227. (Completed LRA Amendment 28) ~~Applicant/Licensee Action Item (A/LAI) #8 Item #5~~ ~~(in part - reactor coolant system water environment portion)~~ ~~Enhance the Fatigue Monitoring program to evaluate the effects of the reactor coolant system water environment on the reactor vessel internal components with existing fatigue CUF analyses to satisfy the evaluation requirements of ASME Code, Section III, Subsection NG-2160 and NG-3121~~. (moved to item 31)	B2.1.6	~~PWR Vessel Internals program implementation and A/LAI #1:~~ ~~Within 24 months after the issuance of MRP-227-A, *PWR Internals Inspection and Evaluation Guideline*~~ Completed.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
6	Enhance the Open-Cycle Cooling Water System program procedures to: • include polymeric material inspection requirements, parameters monitored, and acceptance criteria. Examination of polymeric materials by OCCW System program will be consistent with examinations described in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. • ~~inspect the essential service water strainers for coating degradation.~~ • include inspection and cleaning, if necessary, of the air-side of safety-related air-to-water heat exchangers cooled by essential service water. • ~~inspect for coating detachment indications that affect downstream components during internal coatings inspections and specify acceptance criteria for coating detachment indications. Coatings detachments that are not repaired or removed to leave sound coating bonded to the surface will be evaluated to confirm coating manufacturer installation requirements, tested using techniques identified in ASTM-D7167 to confirm if the coating is bonded to the surface, and trended.~~ • perform periodic visual inspections of the internal coatings of components within the scope of this program to ensure that loss of coating integrity is detected prior to (1) loss of component intended function, including loss of function due to accelerated degradation caused by localized coating failures, and (2) degradation of downstream component performance due to flow blockage. Inspection frequency is based on coating condition. Inspection results will be evaluated by personnel qualified consistent with ASTM D7108-05, “Standard Guide for Establishing Qualifications for a Nuclear Coating Specialist,” as described in the Protective Coating Monitoring and Maintenance program (B2.1.33). Acceptance criteria will include the following: 1. Peeling and delaminations are not permitted 2. Cracking is not permitted if accompanied by delamination or loss of adhesion.	B2.1.10	Completed no later than six months prior to the PEO. Inspections and testing to be completed no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	3. Blisters are limited to intact blisters. Testing will be performed confirm that the blisters are completely surrounded by sound coating bonded to the surface. 4. Localized areas of coating degradation without subsequent loss of material of the base metal are considered acceptable if the area is completely surrounded by sound coating bonded to the surface. • Prior to the period of extended operation, an inspection technique will be selected from available technologies to identify internal pipe wall degradation due to MIC for performance of a one-time inspection of a buried carbon steel piping segment that is representative of other accessible carbon steel ESW piping segments.		

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
9	Enhance the Fire Protection program procedures to: • include visual inspections of the external surfaces of Halon fire suppression system components for excessive loss of material due to corrosion. (Completed LRA Amendment 28) • include trending of the performance of the Halon system during testing. (Completed LRA Amendment 1)	B2.1.13	~~Completed no later than six months prior to the PEO. Inspections and testing to be complete no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.~~ Completed

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
10	Recoat the internal surface of fire water storage tanks. Enhance the Fire Water System program procedures to: ▪ ~~include non-intrusive pipe wall thickness examinations. Wall thickness examinations will be performed on fire water piping to be performed every three years. Each three year sample will include at least three locations for a total of 100 feet of above-ground fire water piping and be selected based on system susceptibility to corrosion or fouling and evidence of performance degradation during system flow testing or periodic flushes. In addition, internal~~ Internal inspections will be performed on accessible exposed portions of fire water piping during plant maintenance activities. When visual inspections are used to detect loss of material, the inspection technique is capable of detecting surface irregularities that could indicate wall loss to below nominal pipe wall thickness due to corrosion and corrosion product deposition. Where such irregularities are detected, follow-up volumetric wall thickness examinations are performed. ~~Pipe wall thickness examinations and internal inspections will be performed commencing after 2014 and throughout the period of extended operation.~~ ▪ replace sprinkler heads prior to 50 years in service or have a recognized testing laboratory field-service test a representative sample in accordance with NFPA 25 and test additional samples every 10 years thereafter to ensure signs of aging are detected in a timely manner. ▪ review and evaluate trends in flow parameters recorded during the NFPA 25 fire water flow tests. ▪ perform annual hydrant flow testing in accordance with NFPA 25. ▪ perform annual hydrostatic testing of fire brigade hose. ▪ Inspect the internal surface of piping and branch lines for foreign material every five years by flushing wet pipe system piping. In buildings having multiple wet pipe systems, every other system is inspected every five years, and the remaining systems	B2.1.14	~~Completed no later than six months prior to the PEO.~~ Implementation is started five years before the period of extended operation. Recoat the internal surface of the fire water storage tanks~~,~~ and, inspections~~, and testing~~ of wetted segments that cannot be drained or that allow water to collect to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO whichever occurs later. The program's remaining inspections begin during the period of extended operation.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	are inspected at the next five year interval. If foreign material is found in any system in a building during the five year inspection, then all systems in the building will be inspected. If sufficient foreign material is found to obstruct pipe or sprinklers, then an obstruction investigation is conducted per NFPA 25, Annex D. Visual inspections will include an inspection technique that is capable of detecting surface irregularities due to corrosion and corrosion product deposition. If the visual inspection detects surface irregularities that could indicate wall loss below nominal pipe wall thickness, then follow-up volumetric examinations will be performed. ▪ Perform augmented tests and inspections of water-based fire protection system components that have been wetted but are normally dry. The augmented tests and inspections are conducted as follows on piping segments that cannot be drained or that allow water to collect: • In each five-year interval, beginning five years prior to the period of extended operation, either conduct a flow test or flush sufficient to detect potential flow blockage, or conduct a visual inspection of 100 percent of the internal surface of piping segments that cannot be drained or allow water to collect. • A 100% baseline inspection will be performed prior to the period of extended operation. In each five-year interval of the period of extended operation, 20 percent of the length of piping segments that cannot be drained or that allow water to collect is subject to volumetric wall thickness inspections. Measurement points will be obtained to the extent that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping that is inspected in each five-year interval will be in different locations than previously inspected piping. If the results of a 100 percent internal visual inspection are acceptable, and the segment is not subsequently wetted, no further augmented tests or inspections will be performed.		

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	▪ require the inspection of the interior of the fire water storage tanks to include checking for evidence of voids beneath the floor. ▪ change the frequency of trip testing each deluge valve from every three years to every refueling outage. ▪ change the frequency of tests of spray/sprinkler nozzle discharge patterns from every three years to every refueling outage. ▪ perform the following additional inspections if pitting, corrosion, or coating failure is found during the inspection of the fire water storage tanks: (1) tank coatings are evaluated using an adhesion test consistent with ASTM D 3359, Standard Test Methods for Measuring Adhesion by Tape Test; (2) dry film thickness measurements are taken at random locations to determine the overall coating thickness; (3) nondestructive ultrasonic readings are taken to evaluate the wall thickness where there is evidence of pitting or corrosion; (4) interior surfaces are spot wet-sponge tested to detect pinholes, cracks, or other compromises in the coating; (5) tank bottoms are tested for metal loss on the underside by use of ultrasonic testing where there is evidence of pitting or corrosion; (6) bottom seams are vacuum-box tested in accordance with NFPA 22, Standard for Water Tanks for Private Fire Protection. ▪ Require the removal of foreign material if its presence is found during pipe inspections to obstruct pipe or sprinklers. In addition, the source of the material is determined and corrected.		

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
13	Enhance the Reactor Vessel Surveillance program to: • determine the vessel fluence by ex-vessel dosimetry, following withdrawal of the final capsule. (Completed Amendment 28) • require that pulled and tested surveillance capsules are placed in storage for future reconstitution or reinsertion unless given NRC approval to discard. (Completed Amendment 28) • specifically require the design change process to evaluate the impact of plant operation changes on reactor vessel embrittlement. (Completed Amendment 14)	B2.1.17 4.2	Completed ~~Completed no later than six months prior to the PEO.~~

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
17	Implement the External Surfaces Monitoring of Mechanical Components program as described in LRA Section B2.1.21	B2.1.21	~~Completed~~ Implemented no later than six months prior to the PEO~~.~~ and ~~Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.~~ inspections to begin during the period of extended operation.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
33	As additional industry and plant-specific applicable operating experience becomes available, it will be evaluated and incorporated into each new program.	~~B2.1.6~~ B2.1.15 B2.1.18 B2.1.19 B2.1.20 B2.1.21 B2.1.23 B2.1.25 B2.1.37 B2.1.38 B2.1.39	Completed consistent with implementation schedule noted with each referenced aging management program.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
34	~~Callaway~~ Ameren Missouri replacement steam generator divider plate assemblies are fabricated of Alloy 690. The divider plate to primary head and tubesheet junctions are welded with Alloy 152 weld materials. The tubesheet cladding is Alloy 182 and the primary head cladding is stainless steel. There is a concern regarding potential failure at the divider plate welds to primary head and tubesheet cladding and ~~Callaway~~ Ameren Missouri commits to perform one of the following three resolution options: Option 1: Inspection Perform a one-time inspection of each steam generator to assess the condition of the divider plate welds. The examination technique(s) will be capable of detecting PWSCC in the divider plate assemblies and the associated welds. OR Option 2: Analysis Perform an analytical evaluation of the steam generator divider plate welds in order to establish a technical basis which concludes that the steam generator reactor coolant system pressure boundary is adequately maintained with the presence of steam generator divider plate weld cracking. The analytical evaluation will be submitted to the NRC for review and approval. OR Option 3: Industry/NRC Studies If results of industry and NRC studies and operating experience document that potential failure of the steam generator reactor coolant system pressure boundary due to PWSCC cracking of steam generator divider plate welds is not a credible concern, this commitment will be revised to reflect that conclusion.	Section 3.1.2.2.11.1, Table 3.1.2-4	Between Fall 2025 and Fall 2029 when the replacement steam generators are in service for more than 20 years.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
35	The material of steam generator tubesheet cladding is Alloy 182. The tubes are made of Alloy 690 and are secured to the tubesheet by means of tube to tubesheet leaktight weld and tube expansion. There is a concern regarding potential failure of primary-to-secondary pressure boundary due to PWSCC cracking of tube-to-tubesheet welds. ~~Callaway~~ Ameren Missouri commits to perform one of the following two resolution options: Option 1: Inspection Perform a one-time inspection of a representative number of tube-to-tubesheet welds in each steam generator to determine if PWSCC cracking is present. The examination technique(s) will be capable of detecting PWSCC in the tube-to-tubesheet welds. If weld cracking is identified, the condition will be resolved through repair or engineering evaluation to justify continued service, as appropriate, and a periodic monitoring program will be established to perform routine tube-to-tubesheet weld inspections for the remaining life of the steam generators. OR Option 2: Analysis Perform an analytical evaluation of the steam generator tube-to-tubesheet welds either determining that the welds are not susceptible to PWSCC, or redefining the reactor coolant pressure boundary of the tubes, where the steam generator tube-to-tubesheet welds are not required to perform a reactor coolant pressure boundary function. The redefinition of the reactor coolant pressure boundary will be submitted as part of a license amendment request requiring approval from the NRC. The evaluation for determination that the welds are not susceptible to PWSCC and do not require inspection will be submitted to the NRC for review.	Section 3.1.2.2.11.2, Table 3.1.2-4	Between Fall 2025 and Fall 2029 when the replacement steam generators are in service for more than 20 years

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
41	To allow for monitoring of the condition of the threads on the RPV stud and flange hole threads, ~~Callaway~~ Ameren Missouri commits to remove RPV stud #18 through non-destructive or destructive means. If RPV stud hole repair is required following removal of RPV stud #18, the repair plan will include inspecting the RPV stud hole prior to the repair to assess the as-found condition and an inspection after the repair is complete to assess the results of the repair.	B2.1.3	Completed no later than six months prior to the PEO or the refueling outage prior to the period of extended operation, whichever occurs later.
42	It is noted that ~~Callaway~~ Ameren Missouri experienced problems with the reactor vessel head closure studs and stud holes early in plant life (1986 – 1992), and that multiple RPV stud holes required ASME Section XI repairs to remove damaged threads. To supplement the monitoring that is accomplished through regular volumetric inspections and to confirm that additional thread degradation is not occurring in the RPV stud holes, ~~Callaway~~ Ameren Missouri commits to perform a one-time inspection of select RPV stud holes using a method consistent with the Babcock and Wilcox laser inspection that was applied following stud hole repair in 1989 and 1992. RPV stud hole locations 2, 4, 5, 7, 9, and 53 have had more than one thread removed and will be inspected. If inspection of these RPV stud holes confirms that there was minimal or no additional degradation since the prior video inspection, then it is a reasonable conclusion that there will be minimal additional degradation in the period of extended operation. If additional degradation is observed in any of the repaired stud holes where more than one thread has been removed, the condition will be entered in the Corrective Action Program for evaluation and corrective action, and the remaining repaired RPV stud hole locations 13, 25, 39 and 54 will be inspected. The inspection is expected to confirm that further degradation is not occurring in the repaired stud holes, and will provide a basis for the conclusion that acceptance criteria for thread engagement will continue to be met through the period of extended operation.	B2.1.3	Completed no later than six months prior to the PEO or the refueling outage prior to the period of extended operation, whichever occurs later.

B2.1.6 PWR Vessel Internals

Program Description

The PWR Vessel Internals program manages cracking, loss of material, loss of fracture toughness, change in dimension, and loss of preload for reactor vessel internal components intended to provide core structural support. The program implements the guidance of EPRI 1022863 (MRP-227-A), *PWR Internals Inspection and Evaluation Guideline* and EPRI 1016609 (MRP-228), *Inspection Standard for PWR Internals*. Applicable aging management program plant-specific action items, conditions and limitations identified in NRC Safety Evaluation for MRP-227 have been addressed in this aging management program.

The program is designed to identify cracking, loss of material induced by wear, loss of fracture toughness due to either thermal aging or neutron irradiation embrittlement, change in dimension due to void swelling and irradiation growth, distortion, or deflection, and loss of preload due to thermal and irradiation-enhanced stress relaxation or creep. The cracking mechanisms managed by this program include stress corrosion cracking (SCC), primary water stress corrosion cracking (PWSCC), irradiation-assisted stress corrosion cracking (IASCC), and cracking due to fatigue/cyclical loading.

The reactor vessel internal components are chosen for one of four inspection sample groups based on the guidance of MRP-227-A. The primary group inspections manage aging consistent with the inspection guidance of Table 4-3 (Westinghouse components) of MRP-227-A and are expected to show the leading indications of aging effects. The expansion group inspections manage aging consistent with Table 4-6 (Westinghouse components) of MRP-227-A after inspections find aging effects to be more severe than anticipated in the primary group inspections. Components in the existing program group inspections, consistent with the inspection guidance in Table 4-9 of MRP-227-A, are adequately managed by existing programs, such as ASME Code, Section XI, Examination Category B-N-3 examinations of core support structures. The fourth group consists of components for which aging effects were determined to be negligible, relative to other internals components, and no additional measures for aging management are specified.

Program examination methods include visual examination (VT-3), enhanced visual examination (EVT-1), volumetric examination, and physical measurements. Visual examinations are performed consistent with the guidance of MRP-227-A. The MRP-227-A guidance is consistent with the ASME Code Section XI rules, and includes additional guidance and methods of detecting relevant conditions. Volumetric examinations of reactor vessel internals, such as bolting, pins, and fasteners, are performed in accordance with the guidance of MRP-228 and MRP-227-A. This guidance includes requirements for the ultrasonic testing techniques used to detect loss of integrity of reactor vessel internals bolts, pins and fasteners.

Integral attachments to the internal surface of the reactor vessel are managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program (B2.1.1) Examination Category B-N-2. Bottom mounted instrumentation flux thimble tubes are managed by the Flux Thimble Tube Inspection program (B2.1.22).

~~The PWR Vessel Internals program is a new program that will be implemented within 24 months after the issuance of MRP-227-A, PWR Internals Inspection and Evaluation Guideline. The program will include future industry operating experience, as it is incorporated into future revisions of MRP-227-A, to provide reasonable assurance for the long-term integrity of the reactor vessel internals.~~

NUREG-1801 Consistency

The PWR Vessel Internals program is ~~a new~~ an existing program that~~, when implemented, will be~~ is consistent with NUREG-1801, Section XI.M16A, *PWR Vessel Internals*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following discussion of operating experience provides objective evidence that the PWR Vessel Internals program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation:

1. Based on industry operating experience, Callaway replaced the Alloy-750 guide tube support pins (split pins) with strained hardened (cold worked) 316 stainless steel pins during Refuel 13 (Spring 2004) to reduce the susceptibility for stress corrosion cracking in the split pins. There were no cracked Alloy X-750 pins discovered during the replacement process.

2. The ASME Code, Section XI, Examination Category B-N-3 examinations of core support structures conducted during the Refuel 13 (Spring 2004), did not identify any conditions that required repair or replacement.

3. With exception of the existing program components managed by ASME Section XI ISI, the Callaway PWR Vessel Internals program will be a new program. A key element of the program defined in MRP-227-A is the requirement to report aging effects of reactor vessel internal components. Callaway, through its participation in PWR Owners Group and EPRI-MRP activities, will continue to benefit from the industry-wide collaboration of results from internals inspections.

The operating experience of the ASME Code, Section XI, Examination Category B-N-3 examinations of core support structures did not identify any significant age-related deficiencies. Occurrences that would be identified under the PWR Vessel Internals program will be evaluated to ensure there is no significant impact to safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. Therefore, there is confidence that implementation of the PWR Vessel Internals program will effectively identify aging prior to loss of intended function.

~~Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.~~

Conclusion

The continued implementation of the PWR Vessel Internals program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.10 Open-Cycle Cooling Water System

Program Description

The Open-Cycle Cooling Water (OCCW) System program manages loss of material, wall thinning, reduction of heat transfer, cracking, blistering, change in color, and hardening and loss of strength for those components that are exposed to the raw water environment of the essential service water (ESW) system and heat exchangers and other components in other systems serviced by the essential service water system.

The activities for this program are consistent with the Callaway commitments to the requirements of NRC Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Components* and provide for management of aging effects in raw water cooling systems through tests, inspections and component cleaning. System and component testing, visual inspections, nondestructive examination (i.e., ultrasonic testing and eddy current testing), and biocide and chemical treatment are conducted to ensure that aging effects are managed such that system and component intended functions and integrity are maintained.

Periodic heat transfer testing or inspection and cleaning of heat exchangers with a heat transfer intended function is performed in accordance with Callaway commitments to NRC Generic Letter 89-13 to verify heat transfer capabilities.

Routine inspections and maintenance of the OCCW System program ensure that corrosion, erosion, sediment deposition and biofouling cannot degrade the performance of safety-related systems serviced by the essential service water system.

The guidelines of NRC Generic Letter 89-13 are utilized for the surveillance and control of biofouling. Procedures provide instructions and controls for biocide injection. Periodic inspections are performed for the presence of mollusks and biocide treatments are applied as necessary.

System walkdowns are performed periodically to assess the material condition of OCCW system piping and components. Compliance with the licensing basis is ensured by review of system design basis documents as well as periodic performance of self assessments.

Callaway uses internal coatings only on the component cooling water heat exchanger end bells, channels, and tubesheets; the control room air conditioner tubesheets; the class 1E electrical equipment air conditioner tubesheets; and the essential service water system strainers. ~~This amount of coating surface area is relatively small and its aging has not been a concern for essential service water system performance.~~The internal coatings of components within the scope of this program are periodically visually inspected to ensure that loss of coating integrity is detected prior to (1) loss of component intended function, including loss of function due to accelerated degradation caused by localized coating failures, and (2) degradation of downstream component performance due to flow blockage.

Examination of polymeric materials by OCCW System program will be consistent with examinations described in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.23).

The external surfaces of the buried OCCW components are managed by the Buried and Underground Piping and Tanks program (B2.1.25). The aging management of closed-cycle cooling water systems is described in B2.1.11, Closed Treated Water Systems program, and is not included as part of this program.

NUREG-1801 Consistency

The Open-Cycle Cooling Water System program is an existing program that, following enhancement, will be consistent with NUREG-1801, Section XI.M20, *Open-Cycle Cooling Water System*.

Exceptions to NUREG-1801

None

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Acceptance Criteria (Element 6)

Procedures will be enhanced to include polymeric material inspection requirements, parameters monitored, and acceptance criteria. Examination of polymeric materials by OCCW System program will be consistent with examinations described in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.23).

Procedures will be enhanced to include inspection and cleaning, if necessary, of the air-side of safety-related air-to-water heat exchangers cooled by essential service water.

Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Acceptance Criteria (Element 6)

~~Procedures will be enhanced to inspect the essential service water strainers for coating degradation.~~

~~Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5) and Acceptance Criteria (Element 6)~~

~~Procedures will be enhanced to inspect for coating detachment indications that could affect downstream components during internal coatings inspections and specify acceptance criteria for coating detachment indications. Coatings detachments that are not repaired or removed to leave sound coating bonded to the surface will be evaluated to confirm coating manufacturer installation requirements, tested using techniques identified in ASTM-D7167 to confirm if the coating is bonded to the surface, and trended.~~

Procedures will be enhanced to perform periodic visual inspections of the internal coatings of components within the scope of this program to ensure that loss of coating integrity is detected prior to (1) loss of component intended function, including loss of function due to accelerated degradation caused by localized coating failures, and (2) degradation of downstream component performance due to flow blockage. Inspection frequency is based on coating condition. Inspection results will be evaluated by personnel qualified consistent with ASTM D7108-05, "Standard Guide for Establishing Qualifications for a Nuclear Coating Specialist," as described in the Protective Coating Monitoring and Maintenance program (B2.1.33). Acceptance criteria will include the following:

- Peeling and delaminations are not permitted.
- Cracking is not permitted if accompanied by delamination or loss of adhesion.
- Blisters are limited to intact blisters. Testing will be performed to confirm that the blisters are completely surrounded by sound coating bonded to the surface.
- Localized areas of coating degradation without subsequent loss of material of the base metal are considered acceptable if the area is completely surrounded by sound coating bonded to the surface.

Detection of Aging Effects (Element 4),

Prior to the period of extended operation, an inspection technique will be selected from available technologies to identify internal pipe wall degradation due to MIC for performance of a one-time inspection of a buried carbon steel piping segment that is representative of other accessible carbon steel ESW piping segments.

Operating Experience

The following discussion of operating experience provides objective evidence that the Open-Cycle Cooling Water System program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation:

1. In 2000, during routine maintenance, Asiatic clams were found in an RHR room cooler, blocking approximately 15 percent of the tubes. In subsequent inspections, clams were found in several service water and essential service water heat exchangers and room coolers. It was determined that the clams originated in the waste treatment clearwell, from which they were flushed into the suction of the service water pumps. The service water pumps distributed the clams to the heat exchangers and room coolers. As corrective action, procedures were strengthened to require more frequent inspections and provide for a more robust chemistry program to control the clams. Corrective action also included plant modifications, such as installing strainers on the discharge line of the service water pumps.

2. In 2001, through-wall corrosion had been observed in the RHR pump room cooler. The exact cause could not be determined but was believed to be from microbiologically influenced corrosion attack. The cooler was repaired.

3. Performance of the containment coolers degraded over time due to debris from the service water system, so that by 2001 there was very little margin available. The design of the original containment cooler coils did not allow them to be mechanically cleaned, and flushing was ineffective. The coils for containment coolers A and B were replaced in Refuel 11 (Spring 2001), and the coils for C and D were replaced in Refuel 12 (Fall 2002). The replacement coils have a removable cover plate which permits access to mechanically clean individual tubes.

4. In 2007, Callaway revised the program so that the component cooling water heat exchangers are the only heat exchangers that are performance tested. In order to maintain heat removal capability of the other NRC Generic Letter 89-13 heat exchangers, Callaway cleans and inspects heat exchangers at regular intervals, as well as performs flow and pressure measurements according to the essential service water flow balance procedure. The inspections check for micro-fouling, and include thermographies or ultrasonic examinations of internal surfaces. These maintenance activities supplement the commitment to thermal performance testing made in response to NRC Generic Letter 89-13. The primary and additional monitoring methods have been determined for each of the NRC Generic Letter 89-13 heat exchangers, in accordance with the guidance of EPRI Technical Report 1007248, *Alternative to Thermal Performance Testing and/or Tube-side Inspections of Air-to-Water Heat Exchangers*.

5 In 2007 while performing UT inspections, it was discovered that the top portion of the “B” ESW pump discharge piping was partially eroded. Extent of condition inspections identified a similar condition on the discharge of the “A” ESW pump. The piping segments were replaced and added to the Raw Water monitoring program to inspect the segments for erosion.

6. From 2008 to 2009, the buried portions of the ESW supply from the ESW pump house and return to the ultimate heat sink cooling tower were replaced with high-density polyethylene (HDPE) piping. In addition, sections of above ground or underground carbon steel piping that interfaces with the buried piping was replaced with stainless steel piping. These modifications were performed as a result of the material condition of the ESW system. These modifications were performed as a result of corrective action documents that have been written concerning pinhole leaks, pitting, and other localized degradation of the ESW piping system.

7. In 2009, the replacement of the emergency diesel generator jacket water heat exchangers was evaluated due to loss of material in the tubes. The evaluation determined that a better material of construction and a better design would minimize aging effects due to raw water environment in the emergency diesel generators. The replacement jacket water heat exchangers and the emergency diesel generator lube oil coolers had tubes made of AL6XN stainless steel and were replaced in Refuel 17 (Spring 2010). The emergency diesel generator intercoolers were replaced in Refuel 18 (Fall 2011), and also have tubes fabricated from AL6XN stainless steel.

8. In 2009, room cooler flow rates had been observed to be low in the RHR pump room cooler and the containment spray pump room cooler. The low flow rates were determined to be from material that was dislodged during weld repairs from the outage prior to flow testing. The coolers were flushed to remove the debris, and flow rates were restored to their normal operating condition.

9. Prior to 2010, the coils for the following safety-related room coolers were replaced due to performance or aging issues: auxiliary building north penetration room cooler, auxiliary building south penetration room cooler, component cooling water pump room cooler train A, component cooling water pump room cooler train B, and spent fuel pool room cooler A. The material for the replacement coils is AL6XN stainless steel.

Actions have been taken to address examples of recurring corrosion due to MIC identified above. Low Frequency Electromagnetic Technique (LFET) is used for screening large areas of piping to detect changes in the wall thickness of the pipe. Thinned areas found during the LFET scan are followed up with pipe wall thickness examinations. In addition to the pipe wall thickness examination, opportunistic visual inspections of the ESW system are also performed whenever the ESW system is opened for maintenance. Prior to the period of extended operation, an inspection technique will be selected from available technologies to identify internal pipe wall degradation due to MIC for performance of a one-time inspection of a buried carbon steel piping segment that is representative of other accessible carbon steel ESW piping segments.

The above examples provide objective evidence that the existing Open-Cycle Cooling Water System program preventive, condition, and performance monitoring activities prevent or detect aging effects. Occurrences that would be identified under the Open-Cycle Cooling Water System program will be evaluated to ensure there is no significant impact to safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. There is confidence that the continued implementation of the Open-Cycle Cooling Water System program will effectively identify aging prior to loss of intended function.

Conclusion

The continued implementation of the Open-Cycle Cooling Water System program, following enhancement, will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.13 Fire Protection

Program Description

The Fire Protection program manages loss of material of fire rated doors, fire dampers, and the Halon system, concrete cracking, spalling, and loss of material of fire barrier walls, ceilings, and floors, and increased hardness, shrinkage, and loss of strength of fire barrier penetration seals. The Fire Protection program is a condition and performance monitoring program comprised of tests and inspections that follow the applicable National Fire Protection Association (NFPA) recommendations.

The program requires visual inspections of not less than 10 percent of each type of penetration seal at least once per refueling cycle (18 months). The program specifies visual inspections of the fire barrier walls, ceilings and floors in structures within the scope of license renewal at a frequency of at least once per 18 months. Inspections of fire barriers include coatings and wraps. Periodic visual and functional tests are used to manage the aging effects of fire doors. The visual inspection frequency for fire doors is at least once per 18 months, and functional tests of closing mechanisms and latches for required doors is at least once per 18 months. Not less than 10 percent of the fire dampers are visually inspected at least once per 18 months.

Visual inspections of the Halon system will be performed to identify conditions of corrosion. A functional test of the Halon system is performed every 18 months, which is in accordance with Callaway's NRC-approved fire protection program (FSAR Table 9.5.1-2, Item 4 SP).

NUREG-1801 Consistency

The Fire Protection program is an existing program that~~,~~ ~~following enhancement, will be~~ is consistent with NUREG-1801, Section XI.M26, *Fire Protection*.

Exceptions to NUREG-1801

None

Enhancements

None

~~Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:~~

~~*Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), and Acceptance Criteria (Element 6)*~~

~~Procedures will be enhanced to include visual inspections of the external surfaces of Halon fire suppression system components for excessive loss of material due to corrosion.~~

Operating Experience

The following discussion of operating experience provides objective evidence that the Fire Protection program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

1. Fire Barrier Penetration Seals

   In 2004, Callaway was notified by Wolf Creek of a concern with the seismic gap isolation seal between the auxiliary building and containment. At Callaway, 11 of the 23 seals were found to be incorrectly installed such that they did not meet a three-hour rated fire barrier. The deficient seals were repaired and a plant procedure was revised to clearly state the requirements for a three-hour rated fire barrier.

   In 2009, a degraded fire barrier penetration seal was discovered, consisting of a void between the penetration seal and sleeve. The seal appeared to be loose from the sleeve, however, no leaks were identified and the seal was repaired.

2. Fire Doors

   Between 2002 and 2011, multiple fire door deficiencies were identified through regular inspections and preventive maintenance, including failure of door to fully close, sticky door latches and door locks, broken door latches, broken door, tight fit and rubbing between double doors, passive door unable to open, panic bar and latch not working, degraded bottom sweep, loose, missing and stripped hinge screws and doors dragging on the floor. The degraded fire doors were repaired and parts were replaced, as necessary to restore proper function of the fire doors.

3. Halon System

   A review of the most recent 10 years of Callaway operating experience was performed and confirmed that the operating experience discussed in NUREG-1801, Section XI.M26 for the Halon system is bounding, i.e., that there is no unique plant specific operating experience in addition to that described in NUREG-1801.

4. Fireproofing

   In 2005, during a fire barrier inspection, a small section of structural steel fireproofing (approximately 1 ft long) was degraded at the ceiling level of Room 3404 (Switchboard Room 4 on 2016 ft elevation of the control building). The affected area was repaired.

The above examples provide objective evidence that the Fire Protection program is capable of detecting and correcting aging effects associated with fire rated doors, fire dampers, fire barrier penetration seals, structural fire barriers, and Halon systems within the scope of license renewal. Occurrences that would be identified under the Fire Protection program will be evaluated to ensure there is no significant impact to safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. There is confidence that the continued implementation of the Fire Protection program will effectively identify aging prior to loss of intended function.

Conclusion

The continued implementation of the Fire Protection program~~, following enhancement,~~ provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.14 Fire Water System

Program Description

~~The Fire Water System program manages loss of material for water-based fire protection systems consisting of aboveground, buried and underground piping, fittings, valves, fire pump casings, sprinklers, nozzles, hydrants, hose stations, standpipes and water storage tanks. Periodic fire main and hydrant inspections and flushing, sprinkler inspections, functional test, and flow tests in accordance with National Fire Protection Association (NFPA) codes and standards ensure that the water-based fire protection systems are capable of performing their intended function. The fire protection system is maintained at the required normal operating pressure and monitored such that a loss of system pressure is immediately detected and corrective actions initiated.~~

The Fire Water System program conducts full-flow testing and visual inspections to ensure that loss of material and flow blockage is adequately managed. This AMP applies to water-based fire protection system components, including sprinklers, nozzles, fittings, valve bodies, fire pump casings, hydrants, hose stations, standpipes, water storage tanks, and above ground, buried, and underground piping and components that are tested consistent with the 2011 Edition of National Fire Protection Association (NFPA) 25, "Inspection, Testing and Maintenance of Water-Based Fire Protection Systems", noted in Table B2.1.14-1. Unless noted in Table B2.1.14-1, flow testing and visual inspections are performed at intervals specified in the 2011 Edition of NFPA 25.

~~The Fire Water System program performs a flow test of the system at least once every three years in accordance with plant procedures meeting the requirements of NFPA 25, including a yard fire loop flush and a flush of associated hydrants. A visual inspection and flow test of yard fire hydrants is performed annually in accordance with NFPA 25.~~

~~The Fire Water System program conducts flow tests through each open head spray/sprinkler nozzle in accordance with NFPA 25, to verify water flow is unobstructed. Prior to 50 years in service, the Fire Water System program requires sprinkler heads to be replaced or have representative samples submitted for field-service testing by a recognized testing laboratory in accordance with NFPA 25. The program field-service tests additional representative samples every 10 years thereafter during the period of extended operation to ensure signs of aging are detected in a timely manner.~~

Either sprinklers are replaced before reaching 50 years inservice or a representative sample of sprinklers from one or more sample areas is tested by using the guidance of the 2011 Edition of NFPA 25 to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

In addition to NFPA codes and standards, portions of the water-based fire protection system that are: (a) normally dry but periodically are subject to flow (e.g., dry-pipe or preaction sprinkler system piping and valves) and (b) that cannot be drained or allow water to collect, are subjected to augmented testing or inspections. Also, portions of the system (e.g., fire service main, standpipe) are normally maintained at required operating pressure and monitored such that loss of system pressure is immediately detected and corrective actions are initiated.

~~Pipe wall thickness examinations are performed on fire water piping using non-intrusive techniques. Wall thickness examinations will be performed on fire water piping every three years. Each three year sample will include at least three locations for a total of 100 feet of above-ground fire water piping and be selected based on system susceptibility to corrosion or fouling and evidence of performance degradation during system flow testing or periodic flushes. The basis for the frequency is that three years is the frequency required by the FSAR for the yard fire loop flush and for the flow tests of the fire water loops. In addition~~, ~~internal~~ Internal inspections are performed on accessible exposed portions of fire water piping during plant maintenance activities. ~~The inspections evaluate wall thickness measurements to ensure against catastrophic failure and the inner diameter of the piping as it applies to the design flow of the fire protection system. If a representative number of inspections have not been completed prior to the period of extended operation, Callaway will determine what additional inspections or examinations are required. The representative sample will be selected, based on system susceptibility to corrosion or fouling and evidence of performance degradation during system flow testing or periodic flushes. If material and environment conditions for above grade and below grade piping are similar, the results of the inspections of the internal surfaces of the above grade fire water piping can be extrapolated to evaluate the condition of the internal surfaces of the below grade fire water piping. If not, additional inspection activities will be performed to ensure that the intended function of below grade fire water piping will be maintained consistent with the current licensing basis. Pipe wall thickness examinations and internal inspections will be performed commencing after 2014 and throughout the period of extended operation.~~

Samples are collected for microbiologically-influenced corrosion quarterly and when fire water piping and components are opened for maintenance or are accessible. Biofouling is prevented by periodically adding treatment chemicals such as an anti-scalant, a biopenetrant, and a biostat to the fire water system annually and when monitoring indicates they should be added. The MIC Index is trended to evaluate treatment effectiveness in specific locations.

~~Functional tests are periodically performed on fire detectors to ensure that they are operable.~~

~~The internal coating of the fire water storage tanks will be inspected with a minimum frequency of alternating refueling outages.~~

~~The fire water storage tank external surfaces are inspected and volumetric examinations of the tank bottom are performed as described in the Aboveground Metallic Tanks program (B2.1.15).~~ External surfaces of buried fire main piping are evaluated as described in the Buried and Underground Piping and Tanks program (B2.1.25).

Inspections of wetted normally dry piping segments that canot be drained or that allow water to collect begin five years before the period of extended operation. The program's remaining inspections begin during the period of extended operation.

Table B2.1.14-1 Fire Water System Aging Management

Component	**NFPA 25 Section**	**Aging Management Performed**
Sprinkler Systems: Sprinkler inspections	5.2.1.1	Sprinklers are inspected for signs of leakage, corrosion, and foreign material.
Sprinkler Systems: Sprinkler testing	5.3.1	Prior to 50 years in service, the Fire Water System program requires sprinkler heads to be replaced or have representative samples submitted for field-service testing by a recognized testing laboratory in accordance with NFPA 25. The program field-service tests additional representative samples every 10 years thereafter during the period of extended operation to ensure signs of aging are detected in a timely manner.
Standpipe and Hose Systems: Flow Tests	6.3.1	Flow testing is conducted at least every five years at the hydraulically most remote hose connections of each zone of an automatic standpipe system to verify the water supply provides the design pressure at the required flow.
Private Fire Service Mains: Underground and Exposed Piping	7.3.1	Underground and exposed piping is flow tested at flows representative of those during a fire to determine the internal condition of the piping at minimum 3-year intervals.
Private Fire Service Mains: Hydrants	7.3.2	Hydrants are flow tested annually to ensure proper functioning.
Fire Pumps: Suction Screens	8.3.3.7	Not applicable. Callaway's fire protection pumps do not have suction screens.

Component	NFPA 25 Section	Aging Management Performed
Water Storage Tanks: Exterior Inspections	9.2.5.5	The exterior painted surface of the fire water storage tanks (FWSTs) is inspected annually for signs of degradation.
Water Storage Tanks: Interior inspections	9.2.6, 9.2.7	The interior of each FWST is inspected every other refueling cycle for signs of aging. Testing of interior surfaces is performed for coating integrity and tank bottom integrity when FWSTs exhibit signs of interior pitting, corrosion, or coating failure.
Valves and System-Wide Testing: Main Drain Test	13.2.5	Main drain tests are not conducted at Callaway. As an alternative, one of the following methods is used to assure the reliable operation of the fire protection water supply system. 1. The fire suppression system is fed from two or more directions such that the failure of one isolation valve will not impair the system and the long runs of pipe are flow tested under other surveillances. OR 2. The flow path from the fire pump to the system control valve is verified on an 18-month frequency, and the following surveillances are performed with acceptable results: • Fire water valve position verification • Fire protection valve cycling • Annual fire protection loop flow test • Fire protection water system flush • Hydrant flush • Post indicator valve testing • Wet pipe, deluge, and preaction system visual inspection
Valves and System-Wide Testing: Deluge Valves	13.4.3.2.2 to 13.4.3.2.5	A full flow test using air or water is performed every refueling outage by trip testing each deluge valve to verify that spray/sprinkler nozzles are unobstructed.
Water Spray Fixed Systems: Strainers	10.2.1.6, 10.2.1.7, 10.2.7	Spray system strainers are inspected and cleaned every refueling outage and after each system actuation. Callaway does not have main line strainers.

Component	NFPA 25 Section	Aging Management Performed
Water Spray Fixed Systems: Operation Test	10.3.4.3	A full flow test is performed every refueling cycle using air or water to verify that spray/sprinkler nozzles are unobstructed.
Foam Water Sprinkler Systems: Strainers	11.2.7.1	Not applicable. Callaway does not have a foam water sprinkler system.
Foam Water Sprinkler Systems: Operational Test Discharge Patterns	11.3.2.6	Not applicable. Callaway does not have a foam water sprinkler system.
Foam Water Sprinkler Systems: Storage tanks	Visual inspection for internal corrosion	Not applicable. Callaway does not have a foam water sprinkler system.
Obstruction Investigation: Obstruction, Internal Inspection of Piping	14.2 and 14.3	The internal surface of piping and branch lines is inspected for foreign material every five years by flushing wet pipe system piping. In buildings having multiple wet pipe systems, every other system is inspected every five years, and the remaining systems are inspected at the next five year interval. If foreign material is found in any system in a building during the five year inspection, then all systems in the building will be inspected. If sufficient foreign material is found to obstruct pipe or sprinklers, then an obstruction investigation is conducted. If the visual inspection detects surface irregularities that could indicate wall loss below nominal pipe wall thickness, then follow-up volumetric examinations will be performed.

NUREG-1801 Consistency

The Fire Water System program is an existing program that, following enhancement, will be consistent, with exception to NUREG-1801, Section XI.M27, *Fire Water System*.

Exceptions to NUREG-1801

Program Element Affected:

Detection of Aging Effects (Element 4)

NUREG-1801 requires inspection of fire protection systems in accordance with the guidance of NFPA-25. Callaway performs power block hose station gasket inspections at least once every 18 months. The inspection interval is in accordance with the approved fire protection program, as described in FSAR Table 9.5.1-2 - SP, Section 5.4, rather than annually as specified by NFPA-25.

NUREG-1801 requires annual testing of fire hydrant hose. Callaway hydrostatically tests fire hoses at interior fire hose stations five years from installation and at least every three years thereafter. The testing interval is in accordance with the approved fire protection program, as described in FSAR Table 9.5.1-2 - SP, Section 5.6.

NFPA 25, Section 13.2.5, requires annual main drain tests. Main drain tests are not conducted at Callaway. Main drain testing is a potentially risk significant activity that requires the discharge of several thousand gallons of water, the disposal of which may be problematic for a nuclear plant. As an alternative, one of the following methods is used to assure the reliable operation of the fire protection water supply system.

1. The fire suppression system is fed from two or more directions such that the failure of one isolation valve will not impair the system and the long runs of pipe are flow tested under other surveillances.

   OR

2. The flow path from the fire pump to the system control valve is verified on an 18-month frequency, and the following surveillances are performed with acceptable results:
   - Fire water valve position verification
   - Fire protection valve cycling
   - Annual fire protection loop flow test
   - Fire protection water system flush
   - Hydrant flush
   - Post indicator valve testing
   - Wet pipe, deluge, and preaction system visual inspection

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

Preventive Actions (Element 2)

The Fire Water Storage Tanks internal surfaces will be recoated prior to the period of extended operation.

Parameters Monitored or Inspected (Element 3) and Detection of Aging Effects (Element 4)

The Fire Water System program will be enhanced to inspect the internal surface of piping and branch lines for foreign material every five years by flushing wet pipe system piping. In buildings having multiple wet pipe systems, every other system is inspected every five years, and the remaining systems are inspected at the next five year interval. If foreign material is found in any system in a building during the five year inspection, then all systems in the building will be inspected. If sufficient foreign material is found to obstruct pipe or sprinklers, then an obstruction investigation is conducted per NFPA 25, Annex D. Visual inspections will include an inspection technique that is capable of detecting surface irregularities due to corrosion and corrosion product deposition. If the visual inspection detects surface irregularities that could indicate wall loss below nominal pipe wall thickness, then follow-up volumetric examinations will be performed.

The Fire Water System program will be enhanced to require augmented tests and inspections of water-based fire protection system components that have been wetted but are normally dry. The augmented tests and inspections are conducted as follows on piping segments that cannot be drained or that allow water to collect:

- In each five-year interval, beginning five years prior to the period of extended operation, either conduct a flow test or flush sufficient to detect potential flow blockage, or conduct a visual inspection of 100 percent of the internal surface of piping segments that cannot be drained or allow water to collect.
- A 100% baseline inspection will be performed prior to the period of extended operation. In each five-year interval of the period of extended operation, 20 percent of the length of piping segments that cannot be drained or that allow water to collect is subject to volumetric wall thickness inspections. Measurement points will be obtained to the extent that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping that is inspected in each five-year interval will be in different locations than previously inspected piping.

If the results of a 100 percent internal visual inspection are acceptable, and the segment is not subsequently wetted, no further augmented tests or inspections will be performed.

Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Acceptance Criteria (Element 6)

~~The Fire Water System program will be enhanced to include non-intrusive pipe wall thickness examinations. Wall thickness measurements will be performed on fire water~~

~~piping every three years. Each three year sample will include at least three locations for a total of 100 feet of above-ground fire water piping, and will be selected based on system susceptibility to corrosion or fouling and evidence of performance degradation during system flow testing or periodic flushes. In addition, internal~~ Internal inspections will be performed on accessible exposed portions of fire water piping during plant maintenance activities. When visual inspections are used to detect loss of material, the inspection technique is capable of detecting surface irregularities that could indicate wall loss to below nominal pipe wall thickness due to corrosion and corrosion product deposition. Where such irregularities are detected, follow-up volumetric wall thickness examinations are performed. ~~Pipe wall thickness examinations and internal inspections will be performed commencing after 2014 and throughout the period of extended operation.~~

Detection of Aging Effects (Element 4)

The Fire Water System program will be enhanced to include annual hydrostatic testing of fire brigade hose.

The Fire Water System program will be enhanced such that prior to 50 years in service, sprinkler heads will be replaced or representative samples will be submitted for field-service testing by a recognized testing laboratory in accordance with NFPA 25. The program will field-service test additional representative samples every 10 years thereafter to ensure signs of aging are detected in a timely manner.

The Fire Water System program will be enhanced to require the inspection of the interior of the fire water storage tanks to include checking for evidence of voids beneath the floor.

The Fire Water System program will be enhanced to change the frequency of trip testing each deluge valve from every three years to every refueling outage.

The Fire Water System program will be enhanced to change the frequency of tests of spray/sprinkler nozzle discharge patterns from every three years to every refueling outage.

The Fire Water System program will be enhanced to require the following additional inspections if pitting, corrosion, or coating failure is found during the inspection of the fire water storage tanks: (1) tank coatings are evaluated using an adhesion test consistent with ASTM D 3359, Standard Test Methods for Measuring Adhesion by Tape Test; (2) dry film thickness measurements are taken at random locations to determine the overall coating thickness; (3) nondestructive ultrasonic readings are taken to evaluate the wall thickness where there is evidence of pitting or corrosion; (4) interior surfaces are spot wet-sponge tested to detect pinholes, cracks, or other compromises in the coating; (5) tank bottoms are tested for metal loss on the underside by use of ultrasonic testing where there is evidence of pitting or corrosion; (6) bottom seams are vacuum-box tested in accordance with NFPA 22, Standard for Water Tanks for Private Fire Protection.

Detection of Aging Effects (Element 4) and Acceptance Criteria (Element 6)

The Fire Water System program will be enhanced to include annual hydrant flow testing in accordance with NFPA 25.

Monitoring and Trending (Element 5)

The Fire Water System program will be enhanced to review and evaluate trends in flow parameters recorded during the NFPA 25 fire water flow tests.

Acceptance Criteria (Element 6)

The Fire Water System program will be enhanced to require the removal of foreign material if its presence is found during pipe inspections to obstruct pipe or sprinklers. In addition, the source of the material is determined and corrected.

Operating Experience

The following discussion of operating experience provides objective evidence that the Fire Water System program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

1. In 2005, during a surveillance test, 10 sprinkler heads had signs of corrosion or mechanical damage. Two of the sprinkler heads were replaced, and the other eight were cleaned. There have been no additional issues with the sprinkler heads since then.

2. In 2005, an alarm was triggered for fire protection loop jockey pump excessive run time and an investigation was initiated to identify the leak. The location of the leak was determined and promptly isolated from the main fire water loop. The isolation of the leak did not affect any required suppression systems. The leak was promptly repaired and the fire water piping was returned to service.

3. In 2006, a low C-factor lead to the fire water system being chemically cleaned, resulting in removal of approximately 8900 pounds of corrosion products. The cleaning was successful in keeping the system C-factor above 91.5 as required by plant procedure. During the chemical cleaning, five leaks developed, all of which were repaired. Since that time, two additional leaks have occurred. One was due to a cracked valve, and the cause of the other is still under investigation.

4. In 2007, an inspection of the train B fire water storage tank, performed in accordance with the Callaway fire water storage tank inspection procedure, identified small amounts of corrosion and mineral deposits, generally at the weld seams. An evaluation determined another application of the tank coating would be planned. In 2009, an inspection of the train B fire water storage tank identified several areas of blistering in the coating, mainly near the welds, and calcium deposits. No major delaminations were identified, and the anodes were in good shape. Minor corrosion was identified on bare metal surfaces, with no pitting. An evaluation determined that the tank internal surfaces were satisfactory. In 2011, an inspection of the train B fire water storage tank was performed. Little to no damage or degradation was found to the internal metallic surface of the tank. There was some surface roughness/pitting when compared to clean bare metal. General blistering and some local delamination of the coating were found. The blistering on the wall and most of the floor is intact, while there was heavy blistering near the welds with smaller blistering on general plate areas. Since the fire water storage tanks are cathodically protected and most of the blisters were intact, the substrate is not expected to degrade significantly by the next inspection or re-coating, and no repair to the exposed metal is necessary.

5. In 2008, an inspection of the train A fire water storage tank identified minor blistering and limestone deposits. No corrosion was found on the tank internal surface, and the tank cathodic protection was found in satisfactory condition. The internal surface of the tank was determined to be in satisfactory condition. In 2010, an inspection of the train A fire water tank identified discontinuities and delaminations of the coating. The weld at the floor to wall interface had the most pitting, and weld locations contained heavy blistering. The adjustments on the rectifier of the cathodic protection system were found to be adequate. An evaluation determined that, since the cathodic protection system was determined to be effective, through voltage and current measurements, the substrate would not degrade excessively before the next planned inspection.

~~4~~6. In 2008, during microbiological sampling of the fire water system, elevated levels of microbiologically influenced corrosion (MIC) were detected in stagnant portions of fire water pipe supplying fire water to hose stations. As a result, a new preventive maintenance task has been created to flush hose stations with a biocide.

~~5~~7. In 2011, C-factor testing was performed on the main fire loop piping to check for restrictions due to corrosion and or biofouling. The testing results did not meet the acceptance criteria, indicating excessive pressure drop leading to reduced fire water flow. The testing results were called into question so with more accurate digital crystal gauges, the system was reevaluated and the results improved by 6% to 89.5, still less than the required acceptance criteria of 91.5. A functionality determination concluded that provided compensatory measures were taken, the reduced cleanliness could be fully offset so the required fire water flow rate could be achieved and maintained. As a corrective action, the acceptance criteria in Calculation KC-005 Addendum 2 have been modified, and the test procedure updated accordingly. These revisions provide significant margin and consider the cleanliness trends, ensuring the fire water system is capable of performing its intended function.

Actions have been taken to address examples of recurring corrosion identified above. Pipe wall thickness examinations will be performed in addition to the opportunistic visual inspections of the fire water system. Sections of the above-ground fire water piping will be tested every three years. Each three year sample will include at least three locations for a total of at least 100 feet of above-ground fire water piping, and will be selected based on system susceptibility to corrosion or fouling and evidence of performance degradation during system flow testing or periodic flushes. This sampling program will commence after 2014, ensuring that over 1000 feet of piping in 30 locations will be inspected during the following 30 years.

MIC samples are collected quarterly and when fire water piping and components are opened for maintenance or are accessible. The MIC Index is trended to evaluate treatment effectiveness in specific locations. Biofouling is prevented by adding treatment chemicals such as an anti-scalant, a biopenetrant, and a biostat to the fire water system annually and when monitoring indicates they should be added.

The above examples provide objective evidence that the existing Fire Water System program includes activities that are capable of detecting aging effects, evaluating system leakage, and initiating corrective actions. Occurrences that would be identified under the Fire Water System program will be evaluated to ensure there is no significant impact to safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. There is confidence that the continued implementation of the Fire Water System program will effectively identify aging prior to loss of intended function.

Conclusion

The continued implementation of the Fire Water System program, following enhancement, provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.15 Aboveground Metallic Tanks

Program Description

The Aboveground Metallic Tanks program manages cracking and loss of material on the external surfaces of outdoor, aboveground metallic tanks within the scope of license renewal that are supported on concrete ~~or soil~~. The program also manages cracking, blistering, and change in color of the acrylic/urethane insulation on the condensate storage tank (CST). The program applies to the CST~~,~~ and refueling water storage tank (RWST).~~, and the two fire water storage tanks (FWSTs).~~ Tanks inside plant structures and protected from the outdoor environment are managed by the External Surfaces Monitoring of Mechanical Components program (B2.1.21).

The Aboveground Metallic Tanks program is a condition monitoring program that performs periodic inspections to monitor for aging effects on the external surfaces of the tank. ~~For the carbon steel FWSTs, the program relies on the application of paint, coatings, or tank bottom edge grout as corrosion preventive measures. In addition, cathodic protection is used on the carbon steel FWSTs as a preventive measure to prevent corrosion on exposed bare metal as-left surfaces of the tanks.~~ For the stainless steel CST and RWST, jacketed insulation with overlapping seams that prevent moisture intrusion or spray-on polyurethane foam insulation that adheres to tank surfaces are used as a corrosion preventive measure. There are no sealants or caulkings applied at the external interfaces between the ~~FWST,~~ CST~~,~~ and RWST and their sloped concrete ~~or soil~~ foundations.

This program performs visual inspections during each refueling cycle to monitor for ~~aging of the tank wall and dome external surface paint or~~ damage of the external surface insulation covering. A one-time inspection of twenty-five external surface locations of approximately one square foot in area will be inspected by removing insulation, with at least ten locations near the base of the tank wall and at least two locations on the dome. Removal of the tank insulation permits ~~a sampling~~ visual and surface examinations of the tank external surfaces to ~~be inspected for aging~~ confirm that environmental impacts are not present at sufficient levels to cause pitting corrosion, crevice corrosion or cracking. Insulation is removed for inspection of the tank surface if insulation damage is detected that would permit water ingress to the tank metallic surface. ~~Painted exterior tank metallic surfaces are inspected for signs of degradation such as flaking, cracking, and peeling, to manage loss of material of the metallic surfaces.~~

The chemical treatments of cooling tower water do not contain chemical compounds that could cause cracking, pitting, or crevice corrosion on the external surfaces of the tanks. ~~Within five years of~~ Prior to entering the period of extended operation and during each ten year period in the period of extended operation, a ~~one-time~~ soil surface sample near the CST and RWST will be performed. The soil surface sample and samples of residue on the top and sides of each tank will be evaluated to ensure that chlorides or other aggressive cooling tower water treatment chemicals are not creating an aggressive environment that would degrade the CST, RWST, or their insulation jacketing.

This program also performs one-time ~~UT thickness measurements~~ volumetric examinations of the bottom of the tank within five years prior to entering the period of extended operation from the internal surface, to determine the thickness of the tank bottom. The entire tank bottom will be scanned to detect loss of material. Thickness measurements will be performed on regions of the tank bottom that indicate a loss of material below nominal plate thickness. ~~With exception of the FWSTs, tank bottom UT thickness measurements will be performed when the tank is drained and within five years of entering the period of extended operation~~. ~~Tank bottom UT thickness measurements of each FWST will be performed at least once every 10 years.~~ A soil sample is taken underneath the CST and RWST and analyzed to demonstrate that the soil is not corrosive. The soil sample is performed prior to entering the period of extended operation and during each ten-year period in the period of extended operation.

A one-time inspection consistent with the One-Time Inspection program (B2.1.18) will be performed on the inside surfaces of the CST and RWST shell, roof and bottom.

The Aboveground Metallic Tanks program is a new program that will be implemented within the five year period prior to the period of extended operation.

NUREG-1801 Consistency

The Aboveground Metallic Tanks program is new program that, when implemented, will be consistent with ~~exception to~~ NUREG-1801, Section XI.M29, *Aboveground Metallic Tanks*.

Exceptions to NUREG-1801

None

~~Program Element Affected~~

~~Detection of Aging Effects (Element 4)~~

~~NUREG-1801 requires UT thickness measurements of the tank bottoms whenever the tank is drained and at least once within five years of entering the period of extended operation. UT thickness measurements of the bottom of each FWST from the internal surface, to determine the thickness of the tank bottom will be performed at least once every ten years. Currently the internal surface of each FWST tank bottom will be visually inspected on an alternating refueling outage frequency. UT thickness measurements may be performed sooner if required by further evaluation of the tank bottom visual inspection results. Ten year periodic UT thickness measurements, supplemented when appropriate based on~~

~~internal visual examinations, will be effective in managing loss of material of the tank bottoms.~~

Enhancements

None

Operating Experience

The following discussion of operating experience provides objective evidence that the Aboveground Metallic Tanks program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

1. The Aboveground Metallic Tanks program is a new program for Callaway. Industry operating experience that forms the basis for this program is included in the operating experience element of the corresponding NUREG-1801, aging management program descriptions. Plant-specific operating experience was reviewed to ensure that the operating experience discussed in the NUREG-1801, aging management program is bounding, i.e., that there is no unique plant-specific operating experience in addition to that described in NUREG-1801. The Callaway Corrective Action Program was searched to determine if aging of the CST or RWST has been identified to date. ~~In 2007, an inspection of the train B fire water storage tank, performed in accordance with the Callaway fire water storage tank inspection procedure, identified small amounts of corrosion and mineral deposits, generally at the weld seams. An evaluation determined another application of the tank coating would be planned. In 2009, an inspection of the train B fire water storage tank identified several areas of blistering in the coating, mainly near the welds, and calcium deposits. No major delaminations were identified, and the anodes were in good shape. Minor corrosion was identified on bare metal surfaces, with no pitting. An evaluation determined that the tank internal surfaces were satisfactory. In 2011, an inspection of the train B fire water storage tank was performed. Little to no damage or degradation was found to the internal metallic surface of the tank. There was some surface roughness/pitting when compared to clean bare metal. General blistering and some local delamination of the coating was found. The blistering on the wall and most of the floor is intact, while there was heavy blistering near the welds with smaller blistering on general plate areas. Since the fire water storage tanks are cathodically protected and most of the blisters were intact, the substrate is not expected to degrade significantly by the next inspection or re-coating, and no repair to the exposed metal is necessary.~~

~~2. In 2008, an inspection of the train A fire water storage tank identified minor blistering and limestone deposits. No corrosion was found on the tank internal surface, and the tank cathodic protection was found in satisfactory condition. The internal surface of the tank was determined to be in satisfactory condition. In 2010, an inspection of the train A fire water tank identified discontinuities and delaminations of the coating. The weld at the floor to wall interface had the most pitting, and weld locations contained heavy blistering. The adjustments on the rectifier of the cathodic protection system were found to be adequate. An evaluation determined that, since the cathodic protection system was determined to be effective, through voltage and current measurements, the substrate would not degrade excessively before the next planned inspection.~~

~~The above examples provide objective evidence that the new Aboveground Metallic Tanks program will be capable of detecting the aging effects associated with this program~~. No cracking or loss of material were identified in a search of Callaway historical information for the CST and RWST. Occurrences that would be identified under the Aboveground Metallic Tanks program will be evaluated to ensure there is no significant impact to the safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. There is confidence that the implementation of the Aboveground Metallic Tanks program will effectively identify aging prior to loss of intended function.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

Conclusion

The implementation of the Aboveground Metallic Tanks program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.17 Reactor Vessel Surveillance

Program Description

The Reactor Vessel Surveillance program manages loss of fracture toughness in accordance with ASTM E 185-73, and the requirements of 10 CFR 50 Appendix H. The surveillance capsules contain reactor vessel steel specimens of the limiting beltline material; and associated weld metal and weld heat affected zone metal. Current examination methods and report requirements are also controlled by commitment to ASTM E 185-82.

The program requires the evaluation of the impact of plant operating changes on the extent of reactor vessel embrittlement (i.e., Charpy upper-shelf energy and pressurized thermal shock screening criteria, and the P-T limit curves, including the effect of lower cold leg temperature or higher fluence).

The last-tested surveillance capsule removed from the reactor vessel, Capsule X, was exposed to fluences equivalent to about 54 effective full power years (EFPY), 3.33×10^{19} neutrons/cm^2 based on the calculated fluence. This fluence exceeds the 60-year peak reactor vessel wall neutron fluence. Capsule results are used to demonstrate compliance with Charpy upper-shelf energy requirements in 10 CFR 50 Appendix G and pressurized thermal shock screening criteria in 10 CFR 50.61, using the methodologies in Regulatory Guide 1.99, *Radiation Embrittlement of Reactor Vessel Materials,* Revision 2. Capsule results are also used to revise pressure-temperature curves and project the end-of-life fluence.

Two standby capsules will be removed at exposures greater than those expected at the beltline wall at 60 years. Capsule Z was removed at 71 EFPY of equivalent exposure and is stored in the spent fuel pool for reinsertion or testing as deemed appropriate. Capsule W will be removed at approximately 108 EFPY of equivalent exposure. This withdrawal schedule meets the ASTM E 185-82 criterion which states that capsules may be removed when the capsule neutron fluence is between one and two times the limiting fluence calculated for the vessel at the end of expected life. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation.

Following withdrawal of the final capsule, vessel fluence will be determined by ex-vessel dosimetry.

NUREG-1801 Consistency

The Reactor Vessel Surveillance program is an existing program that~~, following enhancement, will be~~ is consistent ~~to~~ with NUREG-1801, Section XI.M31, *Reactor Vessel Surveillance*.

Exceptions to NUREG-1801

None

Enhancements

None

~~Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:~~

~~*Detection of Aging Effects - Element 4*~~

~~Following withdrawal of the final capsule, vessel fluence will be determined by ex-vessel dosimetry.~~

~~Testing specification will be enhanced to require that pulled and tested surveillance capsules are placed in storage for future reconstitution or reinsertion unless given NRC approval to discard.~~

Operating Experience

The following discussion of operating experience provides objective evidence that the Reactor Vessel Surveillance program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

1. The last-tested capsule specimens in Capsule X were exposed to fluences equivalent to approximately 54 EFPY, 3.33×10^{19} neutrons/cm^2 based on the calculated fluence, and satisfy the upper-shelf energy criterion and the pressurized thermal shock reference temperature screening criteria. The adjusted reference temperatures have been shown to be less than that used in the P-T limit curves, thereby demonstrating margin in the operating limits.

The operating experience of the Reactor Vessel Surveillance program did not identify an adverse trend in performance. Occurrences that would be identified under the Reactor Vessel Surveillance program will be evaluated to ensure there is no significant impact to safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. There is confidence that the continued implementation of the Reactor Vessel Surveillance program will effectively identify aging prior to loss of intended function.

Conclusion

The continued implementation of the Reactor Vessel Surveillance program~~, following enhancement,~~ provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.21 External Surfaces Monitoring of Mechanical Components

Program Description

The External Surfaces Monitoring of Mechanical Components program manages loss of material and cracking for metallic components and cracking and changes in material properties for cement board (splash panel) components. The program also manages loss of material, cracking, hardening and loss of strength for polymeric components.

Visual inspections of external surfaces will be conducted with system inspections and walkdowns of metallic components for evidence of loss of material and leakage. The inspection parameters for metallic components include material condition, which consists of evidence of corrosion, corrosion stains, material wastage, evidence of insulation damage or wetting; wear, flaking or oxide-coated surfaces; and leakage onto external surfaces. Coating degradation (e.g. cracking, flaking, and blistering) is used as an indicator of possible underlying degradation of the component. Polymer visual inspections will inspect for surface cracking, crazing, discoloration, wear, scuffing, dimensional change, exposure of internal reinforcement, and hardening/loss of strength as evidenced by loss of suppleness during manual or physical manipulation. Stainless steel monitoring will also include visual inspection for cracking when exposed to an aggressive air environment containing halides. Cement board visual inspections will inspect for loss of material or cracking that results in a loss of the component's intended function.

Visual inspections of components in normally accessible locations are conducted at least every refueling outage. This frequency accommodates inspections of components that may be in locations that are normally only accessible during outages. Surfaces that are not readily visible during plant operations and refueling outages are inspected when they are made accessible and at intervals that would ensure the components intended functions are maintained. Inspection intervals for inaccessible components will be determined based on an evaluation of aging effects and their impact on intended functions observed during external surface inspections on accessible components with the same material and environment combination.

Reduced thermal insulation resistance due to moisture intrusion, associated with insulation which is jacketed, is managed by visual inspection of the condition of the jacketing when the insulation has been included in scope to reduce heat transfer from the insulated components. Outdoor insulated components, and indoor components exposed to condensation (because the in-scope component is operated below the dew point), have portions of the insulation inspected or removed to determine whether the exterior surface of the component is degrading or has the potential to degrade.

Visible evidence of degradation will be evaluated to ensure the component's intended functions are maintained. Visual inspection activities will be performed by qualified personnel in accordance with site controlled procedures and processes. Deficiencies are documented and evaluated under the corrective action process.

The following aging management programs manage external surface aging of metallic or polymeric mechanical components outside the scope of the External Surfaces Monitoring program:

1. Boric Acid Corrosion program (B2.1.4) for components in systems near treated borated water or reactor coolant environments where boric acid corrosion may occur.

2. Buried and Underground Piping and Tanks program (B2.1.25) for buried components in buried and underground environments.

3. Aboveground Metallic Tanks program (B2.1.15) for external surfaces of outdoor, above-ground metallic tanks.

4. ASME Section XI ISI, Subsections IWB, IWC, and IWD program (B2.1.1) for Class 1, 2, and 3 pressure-retaining components and their integral attachments.

5. Fire Protection program (B2.1.13) for external surfaces of Halon system and associated components.

The External Surfaces Monitoring of Mechanical Components program is a new program that will be implemented prior to the period of extended operation.

NUREG-1801 Consistency

The External Surfaces Monitoring of Mechanical Components program is a new program that, when implemented, will be consistent with NUREG-1801, Section XI.M36, *External Surfaces Monitoring of Mechanical Components*.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The following discussion of operating experience provides objective evidence that the External Surfaces Monitoring of Mechanical Components program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

1. The External Surfaces Monitoring of Mechanical Components program is a new program, however, external surface monitoring via system walkdown inspections are already in effect at Callaway. Routine system walkdowns are performed as part of the Plant Health and Performance Monitoring Program. The results of the walkdowns provide data for performance monitoring and trending, are an input to work

planning and prioritization process, and are communicated in the System Health Reports and System Performance Monitoring Indicators. The walkdown inspections have been used to effectively maintain the condition of component external surfaces. The scope of these inspections and the inspection techniques are in accordance with industry practice. A review of the plant-specific operating experience for the past 10 years showed that the Plant Health and Performance Monitoring Program has been effective in maintaining the condition of component external surfaces.

2. In 2006, cracking was found on a rubber expansion joint located between the essential service water piping and the diesel generator intercooler heat exchanger. An extent of condition review revealed cracking on the expansion joint of the opposite train. Both expansion joints were replaced. The apparent cause of the cracking was pipe misalignment. The PMs to inspect the heat exchanger tubes were revised to include an inspection of the expansion joints. During the repair, it was discovered that the spare expansion joint in the warehouse was also cracked. As a result, the shelf life of the expansion joints was decreased from 372 months to 60 months. Expansion joint storage methods were changed to require bagging to mitigate their aging effects.

3. In 2006, loss of material due pitting and general corrosion was identified on essential service water supply line piping. A piping ultrasonic test confirmed the piping met minimum wall thickness. The pipe coating was completely restored on all bare metal surfaces of this piping, up to the floor seal. Inspection of safety-related carbon steel cooling piping exposed to aggressive environments and in the vicinity of penetrations through floors, walls, and ceilings was performed to determine extent of condition. No indications of significant corrosion were found as a result of these inspections.

4. In 2006, loss of material due pitting and general corrosion was identified on piping in the pipe chase between the condensate storage tank and the auxiliary building. The piping was ultrasonically examined to determine loss of wall thickness. Piping was replaced or recoated consistent with the results of the ultrasonic examinations. The apparent cause of the corrosion was intrusion of rainwater through the equipment access hatch at ground level outside of the condensate storage tank valve house. The access panel was resealed to prevent rain water intrusion.

5. In 2008, during a mechanical maintenance pre-job walkdown, expansion joint surface cracking was found on the emergency diesel generator intercooler heat exchanger shell side inlet and outlet. The shallow surface cracking was determined to not affect the structural integrity of the joint. The expansion joints are regularly inspected and trended per established preventive maintenance activities, so no further actions were required. During inspection of additional expansion joints on the essential service water system, additional expansion joints with cracks and visible cords were found. Expansion joints containing cracks deep enough to affect the second layer of nylon cording were replaced, since cracking of this layer questions the structural stability of the expansion joint.

The operating experience for the system walkdown inspections that will be incorporated into the External Surfaces Monitoring of Mechanical Components program did not show any adverse trend in performance. Occurrences that would be identified by the system walkdowns will be evaluated to ensure there is no significant impact to the safe operation of the plant and adequate corrective actions will be taken to prevent recurrence. Appropriate guidance for re-evaluation, repair, or replacement will be provided for locations where aging is found. There is confidence that the implementation of the External Surfaces Monitoring of Mechanical Components program will effectively identify aging prior to loss of intended function.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

Conclusion

The implementation of the External Surfaces Monitoring of Mechanical Components program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.23 Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components

Program Description

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program manages cracking, loss of material, hardening and loss of strength. The program inspects internal surfaces of metallic piping, piping components, ducting, polymeric components, and other components that are exposed to plant indoor air, ventilation atmosphere, atmosphere/weather, condensation, borated water leakage, diesel exhaust, lubricating oil, and any water system environment not managed by Open-Cycle Cooling Water System (B2.1.10), Closed Treated Water System (B2.1.11), Fire Water System (B2.1.14), and Water Chemistry (B2.1.2) programs.

Internal inspections are performed opportunistically whenever the internal surfaces are made accessible, such as periodic system and component surveillance activities or maintenance activities. Visual inspections of internal surfaces of plant components are performed by qualified personnel. For certain materials, such as polymers, visual inspections will be augmented by physical manipulation of at least 10 percent of the accessible surface area or pressurization to detect hardening, loss of strength, and cracking. Volumetric evaluations are performed when appropriate for the component environment and material. Volumetric evaluations such as ultrasonic examinations are used to detect stress corrosion cracking of internal surfaces such as stainless steel components exposed to diesel exhaust.

If work opportunities are not sufficient to allow inspection of a representative sample of components, supplemental inspections are also performed. A representative sample size is 20 percent of the accessible and inaccessible component population (defined as components having the same material and environment combination) up to a maximum of 25 components. The locations and intervals for supplemental inspections are based on assessments of the likelihood of significant aging effects, derived from current industry and plant-specific operating experience.

Identified aging deficiencies are documented and evaluated by the Corrective Action Program. Acceptance criteria are established in the maintenance and surveillance procedures or are established during engineering evaluation of the degraded condition. If the inspection results are not acceptable, the condition is evaluated to determine whether the component intended function is affected, and a corrective action is implemented.

Components having the same material-environment combination with repetitive failures due to aging require a plant-specific program, unless the component material has been replaced by a material of more corrosion resistance for the environment of interest.

In addition, the internal coatings of the service water pump strainers are periodically visually inspected to ensure that loss of coating integrity is detected prior to (1) loss of component intended function, including loss of function due to accelerated degradation caused by localized coating failures, and (2) degradation of downstream component performance due to flow blockage.

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new program that will be implemented prior to entering the period of extended operation.

NUREG-1801 Consistency

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new program that, when implemented, will be consistent with exception to NUREG-1801, Section XI.M38, *Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components*.

Exceptions to NUREG-1801

Program Elements Affected:

Scope of Program (Element 1), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)

NUREG-1801 requires a visual examination of the internal surface of components within the scope of this program. The diesel exhaust is not available for internal surface inspection, so a volumetric examination will be performed for this component. The volumetric examination is adequate for detecting loss of material (wall thinning) and cracking of piping and tubing.

Enhancements

None

Operating Experience

The following discussion of operating experience provides objective evidence that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation.

1. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will be a new program at Callaway. Internal surface monitoring through visual inspections conducted during maintenance activities and surveillance testing are already in effect in Callaway. The results of the inspections provide data for performance trending, are an input to work planning and prioritization process, and are communicated in the System Health Reports and System Performance Monitoring Indicators. Plant-specific operating experience since 2000 was reviewed to ensure that the operating experience discussed in the corresponding NUREG-1801 aging management program is bounding, i.e., that there is no unique plant-specific operating experience in addition to that described in NUREG-1801. The review also showed that the Plant Health and Performance Monitoring Program had been effective in maintaining the condition of component internal surfaces.

2. In 2007, during maintenance activities, the threaded tube end plugs on the 'B' centrifugal charging pump room cooler were found to have a loss of material due to corrosion as introduced by wear and deformation to the plugs from the repeated assembly/disassembly and cleanings. None of the plugs were leaking. An evaluation determined that 125 plugs would be replaced, future inspections of the room cooler coils would include inspection of tube plugs for loss of material due to corrosion, and replacements would be determined on a case-by-case basis. Later in 2007, the 'A' containment spray pump room cooler was inspected. There was no noticeable damage to the plugs in this cooler. Additional corrective action was to ensure a continuous on-site availability of enough plugs to replace all the plugs in one room cooler.

Internal inspections conducted during maintenance activities and surveillance testing and the Plant Health and Performance Monitoring Program have been effective in maintaining the condition of component internal surfaces. Occurrences that would be identified under the Internal Surfaces in Miscellaneous Piping and Ducting Components program will be evaluated to ensure there is no significant impact to safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. There is confidence that the implementation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will effectively identify aging prior to loss of intended function.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

Conclusion

The implementation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.