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Question

RAI B.1.25 1 (Internal Surfaces in Miscellaneous Piping and Ducting Components)

Background

GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," as modified by LR ISG 2012 02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation," states parameters monitored or inspected include visible evidence of loss of material in metallic components.

LRA Section B.1.25, "Internal Surfaces in Miscellaneous Piping and Ducting Components," states "[f]or metallic components, visual inspection will be used to detect evidence of loss of material and reduction of heat transfer" and that this new program will be consistent with GALL Report AMP XI.M38, as modified by LR ISG 2012 02.

The LRA (e.g., Table 3.3.2 9, "Combustible Gas Control") states that metallic components will be managed for cracking and reduction of heat transfer using the Internal Surfaces in Miscellaneous Piping and Ducting Components program.

Issue

It is not clear to the staff that the new Internal Surfaces in Miscellaneous Piping and Ducting Components program will be consistent with GALL Report AMP XI.M38 because GALL Report AMP XI.M38 does not include reduction of heat transfer or cracking in metallic components as aging effects. As a result of these apparent inconsistencies, it appears that the LRA has not included sufficient information with regard to various aging management program elements (e.g., "parameters monitored or inspected," "detection of aging effects," "acceptance criteria") to demonstrate that the reduction of heat transfer and cracking for metallic components will be adequately managed by the new Internal Surfaces in Miscellaneous Piping and Ducting Components program.

Request

Clarify whether the new Internal Surfaces in Miscellaneous Piping and Ducting Components program either:

- a) will be consistent with the GALL Report AMP XI.M38 and then provide an alternate aging management program to manage reduction of heat transfer and cracking of metallic components, or
- b) will not be consistent with the GALL Report AMP XI.M38 and then provide the additional information for changes to applicable program elements that demonstrate reduction of heat transfer and cracking of metallic components will be adequately managed

Response (revised)

Note: A previous response to RAI B.1.25-1 was submitted by letter RBG-47835, dated March 26, 2018. The following response compared to the previously submitted response in letter RBG-47835 is verbatim with the exception of a deleted line item in LRA Table 3.3.2-13. The deleted line item addressed stainless steel manifolds managed for cracking using the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. This line item was previously deleted in response to RAI B.1.17-2 by letter RBG-47834, dated March 8, 2018 and was inadvertently included in the original response to this

DRAFT – UNCERTIFIED INFORMATION

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RAI. The following response supersedes the previous response submitted by letter RBG-47835.

The River Bend Station (RBS) Internal Surfaces in Miscellaneous Piping and Ducting Components (ISMPDC) Program will be consistent with the GALL Report AMP XI.M38 as stated in LRA Section B.1.25. Line items in LRA Section 3 tables specifying aging effects of reduction of heat transfer and cracking of metallic components managed by the ISPMDC program are changed to specify that aging effects will be managed by the Periodic Surveillance and Preventive Maintenance Program described in LRA Section B.1.34. In addition, LRA Section A.1.25 and Section B.1.25 are revised to remove reduction of heat transfer and cracking as applicable aging effects for the ISMPDC program.

Changes to LRA Section 3 and Appendix A and B programs follow with additions underlined and deletions lined through.

3.3.2.1.7 Fire Protection – Water System

Aging Management Programs

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

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

3.3.2.1.9 Combustible Gas Control System

Aging Management Programs

The following aging management programs manage the aging effects for the combustible gas control system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Periodic Surveillance and Preventive Maintenance

DRAFT – UNCERTIFIED INFORMATION

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3.3.2.1.11 HPCS Diesel Generator System

Aging Management Programs

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

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

3.3.2.1.12 Control Building HVAC System

Aging Management Programs

The following aging management programs manage the aging effects for the control building HVAC system components.

- Bolting Integrity
- Buried and Underground Piping and Tanks Inspection
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Periodic Surveillance and Preventive Maintenance
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.13 Miscellaneous HVAC Systems

Aging Management Programs

The following aging management programs manage the aging effects for the miscellaneous HVAC systems components.

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

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

Table 3.3.1: Auxiliary Systems					
Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-42	Copper alloy, titanium, stainless steel heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	The heat exchangers of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. Reduction of heat transfer for stainless steel and copper alloy heat exchanger tubes in the fire protection system and stainless steel heat exchanger plates in portion of the service water system not covered by NRC GL 89-13 is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance Program</u> . There are no titanium heat exchanger tubes exposed to raw water in the auxiliary systems in the scope of license renewal.

DRAFT – UNCERTIFIED INFORMATION

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Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-83	Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Cracking due to stress corrosion cracking	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Consistent with NUREG-1801. Cracking of stainless steel diesel engine exhaust components is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance Program.</u>

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**Table 3.3.2-3
Service Water System
Summary of Aging Management Evaluation**

Table 3.3.2-3: Service Water System								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (plates)	Heat transfer	Stainless steel	Raw water (int)	Reduction of heat transfer	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	VII.C1.AP-187	3.3.1-42	E

DRAFT – UNCERTIFIED INFORMATION

DRAFT – UNCERTIFIED INFORMATION

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

Table 3.3.2-7: Fire Protection – Water System								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Copper alloy	Raw water (ext)	Reduction of heat transfer	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	VII.C1.A-72	3.3.1-42	E

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**Table 3.3.2-9
Combustible Gas Control System
Summary of Aging Management Evaluation**

Table 3.3.2-9: Combustible Gas Control System								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Coil	Heat transfer	Stainless steel	Air – indoor (ext)	Reduction of heat transfer	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Piping	Pressure boundary	Stainless steel	Condensation (int)	Cracking	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	H
Tubing	Pressure boundary	Stainless steel	Condensation (int)	Cracking	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	H

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Table 3.3.2-9: Combustible Gas Control System								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Condensation (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	H

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

Table 3.3.2-10: Standby Diesel Generator System								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Expansion joint	Pressure boundary	Stainless steel	Exhaust gas (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	VII.H2.AP-128	3.3.1-83	A-E

DRAFT – UNCERTIFIED INFORMATION

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Table 3.3.2-10: Standby Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – indoor (ext)	Reduction of heat transfer	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Piping	Pressure boundary	Stainless steel	Exhaust gas (int)	Cracking	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	VII.H2.AP-128	3.3.1-83	<u>A-E</u>

DRAFT – UNCERTIFIED INFORMATION

DRAFT – UNCERTIFIED INFORMATION

**Table 3.3.2-11
HPCS Diesel Generator System
Summary of Aging Management Evaluation**

Table 3.3.2-11: HPCS Diesel Generator System								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Expansion joint	Pressure boundary	Stainless steel	Exhaust gas (int)	Cracking	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	VII.H2.AP-128	3.3.1-83	A-E
Heat exchanger (fins)	Heat transfer	Aluminum	Air – indoor (ext)	Reduction of heat transfer	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – indoor (ext)	Reduction of heat transfer	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G

DRAFT – UNCERTIFIED INFORMATION

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Table 3.3.2-11: HPCS Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Exhaust gas (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	VII.H2.AP-128	3.3.1-83	A-E

**Table 3.3.2-12
Control Building HVAC System
Summary of Aging Management Evaluation**

Table 3.3.2-12: Control Building HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Accumulator	Pressure boundary	Stainless steel	Air – outdoor (int)	Cracking	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G

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Table 3.3.2-12: Control Building HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Stainless steel	Air – outdoor (int)	Cracking	<u>Internal Surfaces in-Miscellaneous Piping and Ducting-Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Flex hose	Pressure boundary	Stainless steel	Air – outdoor (int)	Cracking	<u>Internal Surfaces in-Miscellaneous Piping and Ducting-Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Heat exchanger (fins)	Heat transfer	Aluminum	Condensation (ext)	Reduction of heat transfer	<u>Internal Surfaces in-Miscellaneous Piping and Ducting-Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G

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Table 3.3.2-12: Control Building HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Copper alloy	Condensation (ext)	Reduction of heat transfer	<u>Internal Surfaces in-Miscellaneous Piping and Ducting-Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Sight glass	Pressure boundary	Stainless steel	Air – outdoor (int)	Cracking	<u>Internal Surfaces in-Miscellaneous Piping and Ducting-Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Tubing	Pressure boundary	Stainless steel	Air – outdoor (int)	Cracking	<u>Internal Surfaces in-Miscellaneous Piping and Ducting-Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G

DRAFT – UNCERTIFIED INFORMATION

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Table 3.3.2-12: Control Building HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Valve body	Pressure boundary	Stainless steel	Air – outdoor (int)	Cracking	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G

**Table 3.3.2-13
Miscellaneous HVAC System
Summary of Aging Management Evaluation**

Table 3.3.2-13: Miscellaneous HVAC Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (fins)	Heat transfer	Aluminum	Air – outdoor (ext)	Reduction of heat transfer	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	H

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Table 3.3.2-13: Miscellaneous HVAC Systems								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Heat exchanger (fins)	Heat transfer	Aluminum	Condensation (ext)	Reduction of heat transfer	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air – outdoor (ext)	Reduction of heat transfer	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Heat exchanger (tubes)	Heat transfer	Copper alloy	Condensation (ext)	Reduction of heat transfer	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G
Heat exchanger (tubes)	Heat transfer	Stainless steel	Air – indoor (int)	Reduction of heat transfer	Internal Surfaces in Miscellaneous Piping and Ducting Components <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	G

**Table 3.3.2-16
Plant Drains
Summary of Aging Management Evaluation**

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Table 3.3.2-16: Plant Drains								
Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Waste water (int)	Cracking	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	H
Valve body	Pressure boundary	Stainless steel	Waste water (int)	Cracking	<u>Internal Surfaces in Miscellaneous Piping and Ducting Components</u> <u>Periodic Surveillance and Preventive Maintenance</u>	--	--	H

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A.1.25 Internal Surfaces in Miscellaneous Piping and Ducting Components

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages ~~cracking~~, loss of material, ~~reduction of heat transfer~~, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of metallic and elastomeric components in environments of air – indoor, air – outdoor, condensation, exhaust gas, raw water, and waste water. Internal inspections will be performed during periodic system and component surveillances or during the performance of maintenance activities when the surfaces are accessible for visual inspection.

Where practical, the inspections will focus on the bounding or leading components most susceptible to aging because of time in service and severity of operating conditions. At a minimum, in each 10-year period during the period of extended operation, a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population will be inspected. Opportunistic inspections will continue in each period even if the minimum sample size has been inspected.

For metallic components, visual inspection will be used to detect evidence of loss of material ~~and reduction of heat transfer~~. For non-metallic components, visual inspections will be used to detect surface irregularities. Visual examinations of elastomeric components will be accompanied by physical manipulation or pressurization such that changes in material properties are readily observable. The sample size for physical manipulation will be at least 10 percent of accessible surface area.

A.1.34 Periodic Surveillance and Preventive Maintenance

Credit for program activities has been taken in the aging management review for the following components.

- Inspect the internal surfaces of abandoned equipment in the following nonsafety-related systems affecting safety-related systems to manage loss of material:
 - ▶ Leak detection system (system code 207)
 - ▶ Makeup water system (system code 659)
 - ▶ Fuel pool cooling system (system code 602)
 - ▶ Reactor water cleanup system (system code 601)
 - ▶ Standby service water system (system code 256)
 - ▶ Process radiation monitoring system (system code 511)
 - ▶ Floor and equipment drains system (system code 609)
- For metallic components, visually inspect components in the following systems to detect evidence of reduction of heat transfer.
 - ▶ Service water system

DRAFT – UNCERTIFIED INFORMATION

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- ▶ Fire protection – water system
- ▶ Combustible gas control system
- ▶ Standby diesel generator system
- ▶ HPCS diesel generator system
- ▶ Control building HVAC system
- ▶ Miscellaneous HVAC systems
- For metallic components, visually inspect components in the following systems, and when appropriate, perform surface examinations, to detect evidence of cracking.
 - ▶ Combustible gas control system
 - ▶ Standby diesel generator system
 - ▶ HPCS diesel generator system
 - ▶ Control building HVAC system
 - ▶ Plant drains system

B.1.25 Internal Surfaces in Miscellaneous Piping and Ducting Components

Program Description

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program that will manage cracking, loss of material, reduction of heat transfer, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of metallic and elastomeric components in environments of air – indoor, air – outdoor, condensation, exhaust gas, raw water, and waste water. Internal inspections will be performed during periodic system and component surveillances or during the performance of maintenance activities when the surfaces are accessible for visual inspection.

Where practical, the inspections will focus on the bounding or leading components most susceptible to aging because of time in service and severity of operating conditions. At a minimum, in each 10-year period during the period of extended operation, a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population will be inspected. Opportunistic inspections will continue in each period even if the minimum sample size has been inspected.

For metallic components, visual inspection will be used to detect evidence of loss of material and reduction of heat transfer. For non-metallic components, visual inspections will be used to detect surface irregularities. Visual examinations of elastomeric components will be accompanied by physical manipulation or

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pressurization such that changes in material properties are readily observable. The sample size for physical manipulation will be at least 10 percent of accessible surface area.

B.1.34 PERIODIC SURVEILLANCE AND PREVENTIVE MAINTENANCE

Credit for program activities has been taken in the aging management review for the following systems and structures.

<p>Nonsafety-related systems affecting safety-related systems (continued)</p>	<p>Visually inspect the internal surfaces of floor and equipment drains system (system code 609) abandoned piping components to manage loss of material.</p>
<ul style="list-style-type: none"> • <u>Service water system</u> • <u>Fire protection – water system</u> • <u>Combustible gas control system</u> • <u>Standby diesel generator system</u> • <u>HPCS diesel generator system</u> • <u>Control building HVAC system</u> • <u>Miscellaneous HVAC systems</u> 	<p><u>For metallic components, visually inspect components to detect evidence of reduction of heat transfer.</u></p>
<ul style="list-style-type: none"> • <u>Combustible gas control system</u> • <u>Standby diesel generator system</u> • <u>HPCS diesel generator system</u> • <u>Control building HVAC system</u> • <u>Plant drains system</u> 	<p><u>For metallic components, visually inspect components, and when appropriate, perform surface examinations, to detect evidence of cracking.</u></p>

Evaluation

4. Detection of Aging Effects

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Periodic surveillances and preventive maintenance activities provide for component inspections to detect aging effects. Inspection intervals provide timely detection of degradation prior to loss of intended functions. Established inspection methods to detect aging effects of loss of material, and cracking, and reduction of heat transfer include visual inspections, and when appropriate, surface examinations for metallic components. Inspection of elastomeric materials to detect cracking and change in material properties includes visual inspections while manually flexing the component. Manipulation of any specific elastomeric component includes at least 10 percent of available surface area, including visually identified suspect areas.

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