CHAPTER VII

(August 2000)

AUXILIARY SYSTEMS

Major Plant Sections

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A1. New Fuel Storage

A1.1 New Fuel Rack

A1.1.1 New Fuel Rack Assembly

A1. New Fuel Storage

System, Structures, and Components

The system, structures, and components included in this table comprise the new fuel storage which contains carbon steel new fuel storage racks located in the auxiliary building or the fuel handling building. The racks are exposed to temperature and humidity conditions of the auxiliary building. The racks are generally painted with protecting coating. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the new fuel storage are classified as Group C Quality Standards.

System Interfaces

No other systems contained in this report interface with the new fuel storage.

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A1. NEW FUEL STORAGE

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1.1	New Fuel Rack	New Fuel Rack Assembly	Carbon Steel	Indoors: Exposed to temperature and humidity conditions inside the Auxiliary Building or Fuel Handling Building	Loss of Material	General, Pitting and Crevice Corrosion, Coating Degrada-tion	10CFR50.65. NUMARC 93-01, Rev. 2. NRC RG 1.160, Rev. 2.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants and focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 (Maintenance Rule) requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures," emphasizing the importance of monitoring the plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5, "Monitoring of Structures" in Regulatory Guide 1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structures monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License Renewal applicants are encouraged to take credit for existing programs.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.S6 "Maintenance Rule (10 CFR 50.65 – Structural Monitoring."	No

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A1. NEW FUEL STORAGE

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
(continued from previous page) A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the guidelines for an acceptable aging management program for License Renewal, when evaluated against the ten (10) attributes defined in Section 3.0 of the Draft Standard Review Plan for License Renewal (September 1997).		

A2. Spent Fuel Storage

A2.1 Spent Fuel Storage Rack

A2.1.1 Neutron-Absorbing Sheets

A2. Spent Fuel Storage

System, Structures, and Components

The system, structures, and components included in this table comprise the spent fuel storage and contain stainless steel spent fuel storage racks and Boraflex sheets (if used) submerged in a chemically treated oxygenated (BWR) or borated (PWR) water. The intended function of the spent fuel rack is to separate spent fuel assemblies. Boraflex sheets fastened to the storage cells provide for neutron absorption and help maintain subcriticality of spent fuel assemblies in the spent fuel pool. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the spent fuel storage are classified as Group C Quality Standards. In some plants, Boraflex has been replaced by Boral or boron steel.

System Interfaces

No other systems contained in this report interfaces with the spent fuel storage.

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A2.1.1	Spent Fuel Storage Racks	Neutron-Absorbing Sheets	Boraflex, Boral, Boron Steel	Chemically Treated Oxygenated (BWR) or Borated (PWR) Water	Reduction of Neutron-Absorbing Capacity	Boraflex Degrada-tion, Corrosion of Boral or Boron Steel	EPRI NP-6159. EPRI TR-101926. EPRI TR-103300. NRC IN 87-43. NRC IN 93-70. NRC IN 95-38. NRC GL 96-04.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
A Boraflex monitoring program on the test coupons or the actual Boraflex panels, based on manufacturer's recommendations, is implemented in the initial installation of the spent fuel racks to assure that no unexpected degradation of the Boraflex material would compromise the criticality analysis in support of the design of spent fuel storage racks. The applicable AMP, based on manufacturer's suggestion, relies on periodic inspection, testing, monitoring and analysis of the criticality design to assure that the required 5% subcriticality margin is maintained. The frequency of the inspection and testing should be about every 4-5 years based on the manufacturer's recommendation for a 40-year service life for the spent fuel racks. The AMP includes: (1) visual inspection of the physical conditions of the sampling coupons for detecting degradation of the Boraflex material, such as discoloration and reduction of thickness, (2) performing neutron attenuation testing called "blackness testing" to determine gap formation in Boraflex panels, (3) sampling and analysis for silica levels in the spent fuel pool water and trending the results using the RACKLIFE code, (4) measuring boron areal density by the BADGER device, and (5) corrective actions are initiated if the test results find that the 5% subcriticality margin cannot be maintained because of the current or projected future Boraflex degradation. Where Boraflex is replaced with Boral or boron steel, corrosion coupons are placed in the fuel storage pool and periodically tested for corrosion by weight loss measurements and surface inspection.	***(1) Scope of Program***: The AMP is focused on managing the effects of neutron absorbing material degradation on the intended function of the spent fuel racks to prevent criticality. For Boraflex, degradation is caused by the loss of boron carbide neutron absorber due to gradual degradation of the polymer matrix and the release of silica from Boraflex following gamma irradiation and long-term exposure to the wet pool environment, and for Boral or boron steel due to corrosion which is not known to be affected by radiation. ***(2) Preventive Actions:*** Periodic visual inspection of sampling coupons prevents unexpected degradation of the neutron absorbing material. ***(3) Parameters Monitored/Inspected:*** The parameters monitored include physical conditions of the sample coupons such as thickness, discoloration, and hardness, which are conditions directly related to degradation of the Boraflex, Boral, or boron steel material. Operating experience has shown that the degraded surfaces of the test coupons have a gray discoloration. When Boraflex is subjected to gamma radiation and long-term exposure to the spent fuel pool environment, the silicon polymer_matrix becomes degraded and silica filler and boron carbide are released. NRC Information Notice (IN) 95-38 indicated that the loss of boron carbide (washout) from Boraflex is characterized by slow dissolution of the silica from the surface of the Boraflex and a gradual thinning of the material. Visual inspection is used to detect Boraflex degradation such as discoloration and reduction of thickness. In addition, gap formation and decrease of areal boron density is monitored. Degradation of Boral and boron steel is due to oxide film formation and spalling and hence, loss of boron content. **(4)** ***Detection of Aging Effects:*** Because Boraflex contains about 25 percent silica, 25 percent polydimethyl siloxane polymer, and 50 percent boron carbide, sampling and analysis of the presence of silica in the spent fuel pool provide an indication of depletion of boron carbide from Boraflex. In the case of Boral and boron steel, the presence of boride particles in the spent fuel provide evidence of degradation. The amount of boron carbide released from Boraflex is correlated to the levels of silica present in the spent fuel pool. This is supplemented by direct measurement of boron loss using BADGER device. ***(5) Monitoring and Trending:*** The periodic inspection measurements and analysis should provide data for trending. ***(6) Acceptance Criteria:*** The 5% subcriticality margin of the spent fuel racks must be maintained for the period of license renewal. ***(7) Corrective Actions:*** Corrective actions are initiated if the test results find that the 5% subcriticality margin cannot be maintained because of the current or projected future Boraflex degradation. Corrective actions may consist of providing additional neutron absorbing capacity by Boral or boron steel inserts. As discussed in the appendix of this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions.	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continue from previous page) ***(8-9) Confirmation Process, and Administrative Controls:*** Site QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. As discussed in the appendix of this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing confirmation process and administrative controls. ***(10) Operating Experience:*** NRC IN 87-43 addressed the problems of development of tears and gaps (average 1-2 inches, with the largest 4 inches) in the Boraflex material due to gamma radiation-induced shrinkage of the material. IN 93-70, IN 95-38, and NRC Generic Letter (GL) 96-04 address several cases of significant degradation of Boraflex test coupons due to accelerated dissolution of the Boraflex caused by pool water flow through the panel enclosures and the high accumulated gamma dose. Two spent fuel rack cells with about 12-year service have only 40% of the Boraflex remained. In such cases, Boral or boron steel may replace Boraflex as the neutron absorber. Experience with these materials is limited.	

A3. Spent Fuel Pool Cooling and Cleanup (Pressurized Water Reactor)

A3.1 Piping

A3.1.1 Closure Bolting

A3.2 Filter

A3.2.1 Housing

A3.2.2 Closure Bolting

A3.3 Valves (Check and Hand Valves)

A3.3.1 Body and Bonnet

A3.3.2 Closure Bolting

A3.3.3 Lining (Hand Valves Only)

A3.4 Heat Exchanger

A3.4.1 Shell and Access Cover

A3.4.2 Channel Head and Access Cover

A3.4.3 Closure Bolting

A3.5 Ion Exchanger

A3.5.1 Shell

A3.5.2 Nozzles

A3.5.3 Closure Bolting

A3.6 Pump

A3.6.1 Closure Bolting

A3. Spent Fuel Pool Cooling and Cleanup (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the PWR spent fuel pool cooling and cleanup system and consist of piping, valves, heat exchanger, filters and demineralizers, and pump. The system contains borated water. Stainless steel components are not subject to significant aging degradation in borated water and, therefore, are not included in this table. The system removes heat from the spent fuel pool, and transfers the heat to the closed cycle cooling water system, which in turn transfers the heat to the open cycle cooling water system. Based on the Nuclear Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the PWR spent fuel pool cooling and cleanup system are classified as Group C Quality Standards.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the PWR spent fuel cooling and cleanup system are the PWR emergency core cooling system (Table V D1), closed cycle cooling water system (Table VII C2), and PWR chemical and volume control system (Table VII E1).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.1.1	Piping	Closure Bolting	Carbon Steel (CS) Low Alloy Steel (LAS)	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion (BAC)	NRC GL 88-05. ASME Section XI, 1989 or later Edition as approved in 10 CFR 50 55a. NRC IN 86-108.
A3.2.1	Filter	Housing	Carbon Steel (CS) with Lining	Chemically Treated Borated Water	Loss of Material	Pitting and Crevice Corrosion	EPRI TR–105714. (Rev. 3 or later updates or revisions of the report)
A3.2.1	Filter	Housing (External Surface)	CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*
A3.2.2	Filter	Closure Bolting	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of BAC on Item A3.1.1 piping closure bolting.*
A3.3.1	Valves (Check and Hand Valves)	Body and Bonnet	CS with Lining or Stainless Steel (SS) Cladding	Chemically Treated Borated Water	Loss of Material	Pitting and Crevice Corrosion	*Same as for the effect of Pitting and Crevice Corrosion on Item A3.2.1 filter housing.*
A3.3.1, A3.3.2	Valves (Check and Hand Valves)	Body & Bonnet (External Surface), Closure Bolting	Body: CS; Bolting: CS or LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*
A3.3.3	Valves (Hand Valve only)	Linings	Elastomers	Chemically Treated Borated Water	Hardening, Cracking	Rubber Degrada-tion	-

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on implementation of NRC Generic Letter 88-05 and inservice inspection (ISI) in conformance with ASME Section XI (1989 edition), Subsection IWC, Table IWC 2500–1, to monitor the condition of the reactor coolant pressure boundary for occurrence of borated water leakage.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M5, "Boric Acid Corrosion."	No
The AMP relies on the water chemistry program which consists of monitoring and control of water chemistry based on EPRI guidelines of TR-105714 for primary water chemistry in PWRs to manage the effects of loss of material due to crevice or pitting corrosion. However, crevice or pitting corrosion may occur at locations of stagnant flow conditions, and verification of the effectiveness of the chemistry control program should ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. An acceptable verification program consists of a one-time inspection of select component and susceptible locations in the system.	For the evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M11, "Water Chemistry."	Yes, detection of aging effects should be further evaluated
Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*	No
Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*	No
Same as for the effect of Pitting and Crevice Corrosion on Item A3.2.1 filter housing.	*Same as for the effect of Pitting and Crevice Corrosion on Item A3.2.1 filter housing. See Chapter XI.M11, "Water Chemistry".*	Yes, detection of aging effects should be further evaluated
Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*	No
Plant-specific aging management program.	Plant-specific aging management program is to be further evaluated.	Yes, plant-specific

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.4.1, A3.4.2	Heat Exchanger (Serviced by Closed-Cycle Cooling Water System)	Shell and Access Cover, Channel Head and Access Cover.	CS	Shell Side: Closed-Cycle Cooling Water (Treated Water)	Loss of Material	General, Pitting, Crevice, and microbio-logically Induced Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.
A3.4.1 - A3.4.3	Heat Exchanger (Serviced by Closed-Cycle Cooling Water System)	Shell and Access Cover, Channel Head and Access Cover (external surface), and Closure Bolting	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*
A3.5.1, A3.5.2	Ion Exchanger (Demi-neralizer)	Shell, Nozzles,	CS (with Lining)	Chemically Treated Borated Water	Loss of Material	Pitting and Crevice Corrosion	*Same as for the effect of Pitting and Crevice Corrosion on Item A3.2.1 filter housing.*
A3.5.1-A3.5.3	Ion Exchanger (Demineral-izer)	Shell, Nozzles, Closure Bolting	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*
A3.6.1	Pump	Closure Bolting	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The program relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI-TR-107396 for closed-cycle cooling water (CCCW) systems, and performance and functional testing in accordance with the ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their function acceptably.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4 "Closed Cycle Cooling Water System."	No
Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*	No
Same as for the effect of Pitting and Crevice Corrosion on Item A3.2.1 filter housing.	*Same as for the effect of Pitting and Crevice Corrosion on Item A3.2.1 filter housing. See Chapter XI.M11, "Water Chemistry".*	Yes, detection of aging effects should be further evaluated
Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*	No
Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.	*Same as for the effect of Boric Acid Corrosion on Item A3.1.1 piping closure bolting.*	No

A4. Spent Fuel Pool Cooling and Cleanup (Boiling Water Reactor)

A4.1 Piping

A4.1.1 Piping, Fittings, and Flanges

A4.2 Filter

A4.2.1 Housing

A4.3 Valves (Check and Hand Valves)

A4.3.1 Body and Bonnet

A4.3.2 Lining (Hand Valves Only)

A4.4 Heat Exchanger

A4.4.1 Shell and Access Cover

A4.4.2 Channel Head and Access Cover

A4.4.3 Tubes

A4.4.4 Tubesheet

A4.5 Ion Exchanger

A4.5.1 Shell

A4.5.2 Nozzles

A4.6 Pump

A4.6.1 Casing

A4. Spent Fuel Pool Cooling and Cleanup (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the BWR spent fuel pool cooling and cleanup system and consist of piping, valves, heat exchanger, filters and demineralizers, and pump. The system contains chemically treated oxygenated water. The system removes heat from the spent fuel pool, and transfers the heat to the closed cycle cooling water system, which in turn transfers the heat to the open cycle cooling water system. Based on the Nuclear Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the BWR spent fuel pool cooling and cleanup system are classified as Group C Quality Standards.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the BWR spent fuel cooling and cleanup system are the closed cycle cooling water system (Table VII C2) and the condensate system (Table VIII.E).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A4.1.1	Piping	Piping, Fittings, and Flanges	Stainless Steel (SS)	Chemically Treated Oxygenated Water Up to 50°C (125°F)	Loss of Material	Pitting and Crevice Corrosion	EPRI TR–103515. (Rev. 3 or later updates or revisions of the report)
A4.2.1	Filter	Housing	SS; Carbon Steel (CS) with Lining, or SS Cladding	Chemically Treated Oxygenated Water Up to 50°C (125°F)	Loss of Material	Pitting and Crevice Corrosion	EPRI TR–103515. (Rev. 3 or later updates or revisions of the report)
A4.3.1	Valves (Check and Hand Valves)	Body and Bonnet	SS; CS with Lining or SS Cladding	Chemically Treated Oxygenated Water Up to 50°C (125°F)	Loss of Material	Pitting and Crevice Corrosion	EPRI TR–103515. (Rev. 3 or later updates or revisions of the report)
A4.3.2	Valves (Hand Valve only)	Linings	Elastomers	Chemically Treated Oxygenated Water Up to 50°C (125°F)	Hardening, Cracking	Rubber Degrada-tion	-
A4.4.1 - A4.4.3	Heat Exchanger (Serviced by Closed-Cycle Cooling Water System)	Shell and Access Cover, Channel Head and Access Cover, Tubes	CS	Shell Side: Closed-Cycle Cooling Water (Treated Water)	Loss of Material	General, Pitting and Crevice Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The water chemistry program relies on monitoring and control of water chemistry based on the EPRI guidelines of TR-103515 for water chemistry in BWRs to manage the effects of loss of material due to crevice or pitting corrosion. However, crevice or pitting corrosion may occur at locations of stagnant flow conditions, and verification of the effectiveness of the chemistry control program should ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. An acceptable verification program consists of a one–time inspection of select component and susceptible locations in the system.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M11, “Water Chemistry.”	Yes, detection of aging effects should be further evaluated
Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges.	*Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges. See Chapter XI.M11, "Water Chemistry."*	Yes, detection of aging effects should be further evaluated
Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges.	*Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges. See Chapter XI.M11, "Water Chemistry."*	Yes, detection of aging effects should be further evaluated
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
The program relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI-TR-107396 for closed-cycle cooling water (CCCW) systems, and performance and functional testing in accordance with the ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their function acceptably.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4 "Closed Cycle Cooling Water System."	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A4.4.2 - A4.4.4	Heat Exchanger (Serviced by Closed-Cycle Cooling Water System)	Channel Head and Access Cover, Tubes, Tubesheet	Channel Head and Access Cover: SS, CS with SS Cladding; Tubes and Tubesheet: SS	Chemically Treated Oxygenated Water	Loss of Material	General, Pitting, and Crevice Corrosion	EPRI TR–103515. (Rev. 3 or later updates or revisions of the report)
A4.5.1, A4.5.2	Ion Exchanger (Demineral-izer)	Shell, Nozzles,	SS, CS (with Lining)	Chemically Treated Oxygenated Water	Loss of Material	Pitting and Crevice Corrosion	EPRI TR–103515. (Rev. 3 or later updates or revisions of the report)
A4.6.1	Pump	Casing	SS, CS (with SS cladding)	Chemically Treated Oxygenated Water	Loss of Material	Pitting and Crevice Corrosion	EPRI TR–103515. (Rev. 3 or later updates or revisions of the report)

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges.	*Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges. See Chapter XI.M11, "Water Chemistry."*	Yes, detection of aging effects should be further evaluated
Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges.	*Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges. See Chapter XI.M11, "Water Chemistry."*	Yes, detection of aging effects should be further evaluated
Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges.	*Same as for the effect of Pitting and Crevice Corrosion on Item A4.1.1 piping, fittings, and flanges. See Chapter XI.M11, "Water Chemistry."*	Yes, detection of aging effects should be further evaluated

A5. Suppression Pool Cleanup System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the suppression pool cleanup system, which maintains water quality in the suppression pool in boiling water reactors (BWRs). The components of this system include piping, filters, strainers, check valves, hand valves, pumps, and flow orifices. These components are fabricated of carbon, low-alloy, or austenitic stainless steel. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," the components in the suppression pool cleanup system are classified in the same Quality Standards Group as the corresponding components in the spent fuel pool cooling and cleanup system (VII.A4).

Pumps and valves are considered to be active components; seats, discs, and other valve and pump internals should be covered by the plant maintenance program.

System Interfaces

The system that interfaces with the suppression pool cleanup system is the BWR containments (Table II B), or BWR emergency core cooling system (table V D2).

Evaluation Summary

The design of the suppression pool cleanup system in BWRs is plant specific, so it is not possible to generate a generic table describing the applicable aging mechanisms and management programs. However, the system performs a function similar to that performed by the spent fuel pool cooling and cleanup system (VII.A4), and most of the components in the two systems are expected to be identical or very similar. The reader is therefore referred to the table for the spent fuel storage pool system for a listing of aging effects, aging mechanisms, and management programs that should be applicable to the suppression pool cleanup system components. The only component in Table VII.A4 that is not applicable to the suppression pool cleanup system is the heat exchanger (A4.4).

B. Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

B.1 Bridge and Trolley (for cranes that fall within the scope of 10 CFR 54)

B.1.1 Structural Girders

B.2 Rail System

B.2.1 Rail

B. Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

System, Structures, and Components

Most commercial nuclear facilities have between fifty and one-hundred cranes. Many of these cranes are industrial grade cranes that do not fall within the scope of 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and therefore are not required to be part of the integrated plant assessment (IPA). Normally less than ten cranes fall within the scope of 10 CFR 54. The IPA must demonstrate that these cranes are all capable of supporting their rated loads. In addition, a subset of this group must remain fully operational before, during, and after a safe shutdown earthquake. Typically only one or two facility cranes have this functional requirement.

Cranes that are within the scope of 10 CFR 54 also fall within the scope of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The most accurate method of determining which systems and components fall within the scope of these two sections of the CFR is to use the plant probabilistic risk assessment and perform a risk ranking. All of the cranes within the scope of 10 CFR 54 that must be included in the IPA are also included in the 10 CFR 50.65 "Maintenance Rule" and they are therefore monitored quite closely. Dynamic items such as cables, hooks, drums, gear boxes, brakes, relays and bearings are typical components that are the primary focus for the 10 CFR 50.65 inspection and maintenance programs. The main focus of 10 CFR 54, however, is on passive items that are less likely to be inspected under the normal monitoring and maintenance programs. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the overhead heavy load and light load handling systems are classified as Group C Quality Standards.

System Interfaces

No other systems contained in this report interface with the overhead heavy load and light load (related to refueling) handling systems.

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B.1.1	Bridge and Trolley (for Cranes that Fall within the Scope of 10 CFR 54)	Structural Girders	Structural Steel A-36, A-7 or A-285	Air at 70% Relative Humidity and 49°C (120°F)	Cumulative Fatigue Damage	Fatigue	CMAA. Specification #70, ASME NOG-1.
B.1.1	Bridge and Trolley (for Cranes that Fall within the Scope of 10 CFR 54)	Structural Girders	Structural Steel A-36, A-7 or A-285	Air at 70% RH and 49°C (120°F)	Loss of Material	General Corrosion, Coating Degradation	10 CFR 50.65. ASME B30.2. ASME Section XI, 1989 or later edition as approved in 10 CFR 50.55a. Overhead Heavy Load Handling System: NUREG-0612. ANSI N14.6.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Although the number of load cycles for nuclear power plant cranes is usually less than 20,000, components may have been designed or evaluated for a forty (40) year life or they may have been designed to a specific Service Class as defined in CMAA Specification #70 or ASME NOG-1. However, due to their age, some cranes may have been designed by their manufacturers using a fatigue analysis that employed a cumulative usage factor (CUF). It should be demonstrated that the analysis that was originally done is still applicable for the period of license renewal.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal.	Yes TLAA
Structures, systems and components that fall within the Scope of 10 CFR 54.4, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, also fall within the Scope of 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. An acceptable monitoring program should meet all of the requirements of the ASME B30.2 specification for Overhead and Gantry Cranes and should include plant system walkdowns, following the guidance provided by the ASME Code Section XI for VT-3, which recommends visual inspection of paint and coatings during each outage and reporting the walkdown results. When coating degradation is found, plant maintenance procedures should be reviewed and corrective actions should be initiated as necessary.	**(1) Scope of Program:** The program is focused on managing the effects of general corrosion on the structural reliability of the component. ***(2) Preventive Actions:*** Paint or coating prevents or mitigates corrosion on the external portions of the girders. Internal surfaces may be painted or coated. ***(3) Parameters Monitored/ Inspected:*** The AMP only controls and monitors the loss of material from the external surfaces of the girders. ***(4) Detection of Aging Effects:*** Inspection and confirmation that the paint or coating is intact is an effective method of ensuring that the effects of corrosion on the external surfaces of the girders is minimized. The ASME Section XI Code relies on VT-3 for visual inspection of certain components and therefore VT-3 inspection is appropriate for structural girders. Because it is difficult to inspect and repair internal surfaces, other methods such as ultrasonic inspection should be used to monitor for loss of material from the internal surfaces of the girder. ***(5) Monitoring and Trending:*** Based upon the annual loss of material determined from the inspection program, an estimate can be made of the annual loss of material from the girder. Based on this rate, an estimate of the thickness of the material at the end of license renewal can be made. ***(6) Acceptance Criteria:*** The original crane manufacture/ designer or other responsible organization should be consulted to determine if the crane will be capable of meeting its structural and functional guidelines at the end of license renewal. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions, confirmation process, and administrative controls. ***(10) Operating Experience:*** There has been no history in the nuclear industry of corrosion related degradation that has impaired crane girders from meeting their structural and functional guidelines.	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B.2.1	Rail System	Rail	A-759	Air at 70% Relative Humidity (RH) and 49°C (120°F)	Loss of Material	Wear	*Same as for the effect of General Corrosion and coating degradation on Item B.1.1 structural girders.*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effect of General Corrosion and coating degradation on Item B.1.1 structural girders.	*Same as for the effect of General Corrosion and coating degradation on Item B.1.1 structural girders.*	No

C1 Open Cycle Cooling Water System (Service Water System)

C1.1 Piping

C1.1.1 Piping and Fittings

C1.1.2 Underground Piping and Fittings

C1.2 Valves

C1.2.1 Body and Bonnet

C1.3 Heat Exchanger

C1.3.1 Shell and Access Cover

C1.3.2 Channel

C1.3.3 Channel Head and Access Cover

C1.3.4 Tubesheet

C1.3.5 Tubes

C1.4 Flow Orifice

C1.4.1 Body

C1.5 Pump

C1.5.1 Casing

C1.6 Basket Strainer

C1.6.1 Body

C1. Open Cycle Cooling Water System (Service Water System)

System, Structures, and Components

The system, structures, and components included in this table comprise the open-cycle cooling water (OCCW) (or service water) system which consists of piping, heat exchangers, pumps, flow orifices, basket strainers, and valves, including the containment isolation valves. Because the characteristics of OCCW system may be unique to each facility, the OCCW system is defined as a system or systems that transfer heat from safety–related systems, structures, and components (SSCs) to the ultimate heat sink (UHS) such as a cooling pond, cooling tower, river, lake, or sea. The system removes heat from the closed cycle cooling water system and, in some plants, other auxiliary systems and components such as steam turbine bearing oil coolers, or miscellaneous coolers in the condensate system. The only heat exchangers this table addresses are those removing heat from the closed cycle cooling system; heat exchangers for removing heat from other auxiliary systems and components are addressed in their respective systems, such as Table VIII A for steam turbine bearing oil coolers and Table VIII E for condensate system coolers. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the open cycle cooling water system are classified as Group C Quality Standards.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the open cycle cooling water system include the closed cycle cooling water system (Table VII C2), ultimate heat sink (Table VII C3), emergency diesel generator system (Table VII H2), containment spray system (Table V A), PWR steam generator blowdown system (Table VIII F), condensate system (VIII E), auxiliary feedwater system (PWR) (VIII G), emergency core cooling system (PWR) (V D1), and emergency core cooling system (BWR) (V D2).

VII AUXILIARY SYSTEMS

C1. OPEN CYCLE COOLING WATER SYSTEM (Service Water System)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.1.1	Piping	Piping and Fittings (with or without Internal Lining or Coating)	Carbon Steel (CS) (for fresh water only) Aluminum (Al)-Bronze, Brass, Copper-Nickel (Cu-Ni)	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General (CS only), Dealloying (of Al-Bronze), Micro-biologicall y-Influenced Corrosion (MIC), Pitting, and Crevice Corrosion.	NRC GL 89-13. NRC GL 89-13, Supplement 1. NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96.
C1.1.1	Piping	Piping and Fittings (with or without Internal Lining or Coating)	Brass, Copper-Nickel, CS (for fresh water only) Al-Bronze	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	*Same as for the effect of General Corrosion (of CS), Dealloying (of Al-Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).*
C1.1.2	Piping	Underground Piping and Fittings (External Surface, with or without Organic Coating or Wrapping)	CS	Soil	Loss of Material	General, Galvanic, MIC, Pitting, and Crevice Corrosion	NACE RP-01-69.
C1.2.1	Valves (Check, Hand, Control, and Containment Isolation Valves)	Body and Bonnet (with or without Internal Lining or Coating)	Bronze, Al-Bronze, Stainless Steel (SS), CS (for fresh water only)	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General (CS only), Dealloying (Al-Bronze), MIC, Pitting, Crevice Corrosion.	*Same as for the effect of General Corrosion (of CS), Dealloying (of Al-Bronze), MIC, Pitting, and Crevice Corrosion on piping (C1.1.1).*
C1.2.1	Valves (Check, Hand, Control, and Containment Isolation Valves)	Body and Bonnet (with or without Internal Lining or Coating)	Bronze, SS, CS (for fresh water only) Al-Bronze	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1).*
C1.3.1 through C1.3.5	Heat Exchanger (between open cycle and closed cycle cooling water systems)	Shell, Channel, Channel Head, Tube Sheet, Tubes	Shell, Channel, Channel Head: CS/ Tube sheet: Aluminum-Bronze/ Tubes: CuNi	Shell Side: Treated Water; Tube Side: Raw Untreated Salt or Fresh Water	Loss of Material	General, Dealloying (Aluminu m-Bronze), MIC, Pitting, Crevice Corrosion, Galvanic Corrosion	*Same as for the effect of General Corrosion (of CS), Dealloying (of Al-Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on implementation of the recommendations of Generic Letter 89-13 to ensure that open-cycle cooling water (OCCW) (or service water) system can be managed for an extended period of operation. The program includes surveillance and control techniques to manage flow blockage problems caused by biofouling, corrosion, erosion, protective coating failures, and silting, in OCCW systems or structures and components serviced by OCCW systems.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M3, "Open Cycle Cooling Water System."	No
Same as for the effect of General Corrosion (of CS), Dealloying (of Al-Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).	*Same as for the effect of General Corrosion (of CS), Dealloying (of Al- Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).*	No
The program includes preventive measures to mitigate corrosion by protecting the external surface of the buried piping and components, per standard industry practice, with external coating, wrapping, and a cathodic protection system, and surveillance.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M8 "Outer Surface of Buried Piping and Components."	No
Same as for the effect of General (for CS), Dealloying (of Aluminum- Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).	*Same as for the effect of General (for CS), Dealloying (of Aluminum- Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).*	No
Same as for the effect of Biofouling on piping and fittings (Item C1.1.1).	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1).*	No
Same as for the effect of General (for CS), Dealloying (of Aluminum- Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).	*Same as for the effect of General (for CS), Dealloying (of Aluminum- Bronze), MIC, Pitting, and Crevice Corrosion on piping (Item C1.1.1).*	No

VII AUXILIARY SYSTEMS

C1. OPEN CYCLE COOLING WATER SYSTEM (Service Water System)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.3.1 through C1.3.5	Heat Exchanger (between open cycle and closed cycle cooling water systems)	Shell, Channel, Channel Head, Tube Sheets, Tubes	Shell, channel, and channel head: CS/ Tube sheet: aluminum-bronze/ Tubes: Cu-Ni	Shell Side: Treated Water/ Tube Side: Raw Untreated Salt or Fresh Water	Buildup of Deposit, Loss of Flow, Loss of Heat Transfer	Biofouling	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1).*
C1.4.1	Flow Orifices	Body	SS	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, MIC, Pitting, and Crevice Corrosion	*Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).*
C1.4.1	Flow Orifices	Body	SS	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit, Flow Blockage	Biofouling	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1*
C1.5.1	Pump	Casing	CS	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, MIC, Pitting, and Crevice Corrosion, and Low Flow Cavitation	*Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).*
C1.5.1	Pump	Casing	Cast Steel, CS	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1*
C1.6.1	Basket Strainer	Body	CS, SS	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, MIC, Pitting, and Crevice Corrosion	*Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).*
C1.6.1	Basket Strainer	Body	CS, SS	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effect of Biofouling on piping and fittings (Item C1.1.1)	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1)*	No
Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).	*Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).*	No
Same as for the effect of Biofouling on piping and fittings (Item C1.1.1)	*Same as for the effect of Biofouling on piping and fittings (Item C1.1.1)*	No
Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).	*Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).*	No
Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.	*Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.*	No
Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).	*Same as for the effects of General, MIC, Pitting, and Crevice Corrosion on valve body and bonnet (Item C1.2.1).*	No
Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.	*Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.*	No

C2 Closed Cycle Cooling Water System

C2.1 Piping

C2.1.1 Pipe, Fittings, and Flanges

C2.2 Valves (Check, Hand, Control, Relief, and Solenoid Valves)

C2.2.1 Body and Bonnet

C2.3 Pump

C2.3.1 Casing

C2.4 Tank

C2.4.1 Shell

C2.5 Flow Orifice

C2.5.1 Body

C2. Closed Cycle Cooling Water System

System, Structures, and Components

The system, structures, and components included in this table comprise the closed cycle cooling water (CCCW) system which consists of piping, radiation element, temperature element, heat exchangers, pumps, tanks, flow orifices, and valves, including the containment isolation valves. The system contains chemically treated demineralized water. The closed cycle cooling water system is designed to remove heat from various auxiliary systems and components such as chemical and volume control system, spent fuel cooling system, etc., to the open–cycle cooling water system (Table VII C1). A CCCW system is defined as part of the service water system that is not subject to significant sources of contamination, one in which water chemistry is controlled, and one in which heat is not directly rejected to a heat sink. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the closed cycle cooling water system are classified as Group C Quality Standards.

The Aging Management Programs (AMPs) of the heat exchanger between the closed cycle and the open cycle cooling water systems are addressed in the open cycle cooling water system (Table VII C1). The AMPs of the heat exchangers between the closed cycle cooling water system and the interfacing auxiliary systems are included in their respective systems, such as Table VII A3 for PWR spent fuel pool cooling and cleanup system, Table VII A4 for BWR spent fuel pool cooling and cleanup system, and Table VII E1 for chemical and volume control system.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the closed cycle cooling water system include the open cycle cooling water system (Table VII C1), PWR spent fuel pool cooling and cleanup system (Table VII A3), BWR spent fuel pool cooling and cleanup system (Table VII A4), chemical and volume control system (Table VII E1), BWR reactor water cleanup system (Table VII E3), shutdown cooling system (older BWR, Table VII E5), primary containment heating and ventilation system (Table VII F3), fire protection (Table VII G), emergency diesel generator system (Table VII H2), PWR containment spray system (Table V A), PWR and BWR emergency core cooling systems (Tables V D1 and V D2), PWR steam generator blowdown system (Table VIII F), condensate system (VIII E), and steam generator blowdown system (PWR) (VIII G).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C2.1.1	Piping	Pipe, Fittings, and Flanges	Carbon Steel (CS)	35°C (95°F) Treated Water	Loss of Material	General, Pitting, and Crevice Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.
C2.2.1	Valves (Check, Hand, Control, Relief, Solenoid, and Containment Isolation Valves)	Body and Bonnet	CS	35°C (95°F) Treated Water	Loss of Material	General, Pitting, and Crevice Corrosion	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*
C2.3.1	Pump	Casing	CS	35°C (95°F) Treated Water	Loss of Material	General, Pitting, and Crevice Corrosion	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*
C2.4.1	Tank	Shell	CS	35°C (95°F) Treated Water	Loss of Material	Pitting and Crevice Corrosion	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*
C2.5.1	Flow Orifice	Body	CS	35°C (95°F) Treated Water	Loss of Material	Pitting and Crevice Corrosion	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*
C2.6.1	Lube Oil Cooler	Tubes	Brass	Shell Side (Oil), Tube Side (Component Cooling Water)	Crack Initiation and Growth	IGSCC due to Nitrites in Component Cooling Water	-

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI TR–107396 for closed–cycle cooling water (CCCW) systems, and performance and functional testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their function acceptably.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4, "Closed Cycle Cooling Water System."	No
Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*	No
Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*	No
Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*	No
Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).	*Same as for the effects of General, Pitting, and Crevice Corrosion on piping. fittings, and flanges (C2.1.1).*	No

C3 Ultimate Heat Sink

C3.1 Piping

C3.1.1 Piping and Fittings

C3.2 Valves (Check, Hand, and Control Valves)

C3.2.1 Body and Bonnet

C3.3 Pump

C3.3.1 Casing

C3. Ultimate Heat Sink

System, Structures, and Components

The ultimate heat sink (UHS) consists of a lake, ocean, river, spray pond, or cooling tower and provides sufficient cooling water for safe reactor shutdown and reactor cooldown via the residual heat removal system or other similar system. Due to the varying configurations of connections to lakes, oceans, and rivers, a plant specific aging management program (AMP) is required. Appropriate AMPs shall be provided to trend and project (1) Deterioration of earthen dams and impoundments; (2) rate of silt deposition; (3) meteorological, climatological, and oceanic data since obtaining the Final Safety Analysis Report (FSAR) data; (4) water level extremes for plants located on rivers; and (5) aging degradation of all upstream and downstream dams affecting the UHS.

The systems, structures and components included in this table consist of piping, valves and pumps. The cooling tower is addressed in the water-control structures (Table III A6). The ultimate heat sink absorbs heat from the open cycle cooling water system and the piping and valves are classified as Class 3.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the ultimate heat sink include the open cycle cooling water system (Table VII C1) and emergency core cooling systems (Tables V D1 and D2).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.1.1	Piping	Piping and Fittings (With or Without Internal Lining or Coating)	Carbon Steel (CS) Brass, Copper-Nickel,	Raw Untreated Fresh Water	Loss of Material	General (for CS without internal lining or coating) Micro-biologically-Induced (MIC), Pitting, and Crevice Corrosion. Selective Leaching (for brass material)	NRC GL 89-13. NRC GL 89-13, Supplement 1. NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96.
C3.2.1	Check, Hand, & Control Valves	Body and Bonnet (with or without internal lining or coating	Bronze, Stainless Steel	Raw Untreated Fresh Water	Loss of Material	MIC, Pitting, and Crevice Corrosion. Selective Leaching (for bronze material)	*Same as for the effect of General (for CS without internal lining or coating) Micro-biologically-Induced (MIC), Pitting, and Crevice Corrosion. Selective Leaching (for brass material on piping) (Item C3.1.1).*
C3.3.1	Pump	Casing (with or without internal lining or coating)	CS	Raw Untreated Fresh Water	Loss of Material	General, MIC, Pitting, and Crevice Corrosion	*Same as for the effect of General (for CS without internal lining or coating) Micro-biologically-Induced (MIC), Pitting, and Crevice Corrosion. Selective Leaching (for brass material on piping) (Item C3.1.1).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on implementation of the recommendations of Generic Letter 89-13 to ensure that open-cycle cooling water (OCCW) (or service water) system can be managed for an extended period of operation. The program includes surveillance and control techniques to manage flow blockage problems caused by biofouling, corrosion, erosion, protective coating failures, and silting, in OCCW systems or structures and components serviced by OCCW systems.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M3, "Open Cycle Cooling Water System."	No
Same as for the effect of General (for CS without internal lining or coating) Micro-biologically-Induced (MIC), Pitting, and Crevice Corrosion. Selective Leaching (for brass material on piping) (Item C3.1.1).	*Same as for the effect of General (for CS without internal lining or coating) Micro-biologically-Induced (MIC), Pitting, and Crevice Corrosion. Selective Leaching (for brass material on piping) (Item C3.1.1).*	No
Same as for the effect of General (for CS without internal lining or coating) Micro-biologically-Induced (MIC), Pitting, and Crevice Corrosion. Selective Leaching (for brass material on piping (Item C3.1.1).	*Same as for the effect of General (for CS without internal lining or coating) Micro-biologically-Induced (MIC), Pitting, and Crevice Corrosion. Selective Leaching (for brass material on piping (Item C3.1.1).*	No

D. Compressed Air System

D.1 Piping

D.1.1 Piping and Fittings

D.1.2 Closure Bolting

D.2 Air Accumulator

D.2.1 Shell and Access Cover

D.2.2 Closure Bolting

D.3 Valves (including check valves and containment isolation valves)

D.3.1 Body and Bonnet

D.3.2 Closure Bolting

D.4 Filter

D.4.1 Shell and Access Cover

D.4.2 Closure Bolting

D.5 Dryer

D.5.1 Shell and Access Cover

D.5.2 Closure Bolting

D.6 Pressure Regulators

D.6.1 Body and Bonnet

D. Compressed Air System

System, Structures, and Components

The system, structures, and components included in this table comprise the compressed air system that consists of piping, valves including containment isolation valves, air accumulators, filters and dryers. The system components and piping are located in various buildings at most nuclear power plants. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” all components in the compressed air system are classified as Group "D" Quality Standards. However, the cleanliness of these components and high air quality must be maintained because the air provides the motive power for instruments and active components (some of them safety-related) which may not function properly because of contamination from the non-safety Group D equipment.

The pumps and valve internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

Various other systems contained in this report may interface with the compressed air system.

VII AUXILIARY SYSTEMS
D. COMPRESSED AIR SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
D.1.1 D.1.2	Piping	Piping and Fittings, Closure Bolting	Carbon Steel (CS) and Low-Alloy Steel	Internal: Dry, Oil-Free Air (may have Trace of Oil and Water)	Loss of Material	General and Pitting Corrosion	NRC IN 81-38. NRC IN 87-28. NRC IN 87-28 S1. NRC GL 88-14. INPO SOER 88-01. ASME OM Guide Part 17. ISA-S7.0.1-1996. EPRI/NMAC NP-7079S. LER 50-237/ 94-005-3.
D.2.1, D.2.2	Air Accumulator	Shell and Access Cover, Closure Bolting	CS	Internal: Dry, Oil-free Air (may have Trace of Oil and Water)	Loss of Material	General and Pitting Corrosion	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP is based on NRC Generic Letter (GL) 88-14 and INPO's Significant Operating Experience Report (SOER) 88-01. It also relies on the ASME Operation and Maintenance (OM) Guide Part 17, ISA-S7.0.1-1996 and EPRI/NMAC NP-7079S as guidance for testing and monitoring of air quality and moisture.	***(1) Scope of Program:*** The program relies on improved system inspection and on a maintenance program to manage the effects of corrosion on the intended function of the compressed air system. The AMP includes frequent leak testing of valves, piping, and other system components, especially those made of carbon steel, and a preventive maintenance program to check air quality at several locations in the system. ***(2) Preventive Actions:*** The system air quality is monitored and maintained in accordance with manufacturer's recommendations for individual components and guidelines based on OM-17, ISA-S7.0.01-1996 and EPRI/NMAC NP-7079S. ***(3) Parameter Monitored/ Inspected:*** Based on NRC GL 88-14 guidelines, inservice testing is performed to verify proper air quality, and that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the air system is maintained. The preventive maintenance program addresses various aspects of the inoperability of air-operated components due to the presence of oil, water, rust, and other contaminants. ***(4) Detection of Aging Effects:*** Degradation of the piping would become evident by observation of unacceptable leakage rates. Following guidelines in the ASME OM-17 would assure timely detection of degradation of the compressed air system function. ***(5) Monitoring and Trending:*** Effects of corrosion are detectable by periodic local leak rate tests that also provide for timely detection of aging effects based on operating experience. ***(6) Acceptance Criteria*** The testing results are used to verify that the design and performance of the entire air system is in accordance with its intended function. ***(7) Corrective Actions:*** Corrective actions are taken if any parameters are out of acceptable ranges, such as moisture content in the system air. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions. ***(8-9) Confirmation Process and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with 10 CFR Part 50 Appendix B requirements and will continue to be adequate for license renewal. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing confirmation process and administrative controls. ***(10) Operating Experience:*** Potentially significant problems pertaining to air systems have been documented in NRC IN 87-28, 87-28 S1, and LER 50-237/94-005-3. Some of the systems that have been significantly degraded or have failed include decay heat removal, auxiliary feedwater, main steam isolation, containment isolation, and fuel pool seal system.	No
Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
D.3.1, D.3.2	Valves (Including Check Valves and Containment Isolation Valves)	Body and Bonnet, Closure Bolting	CS	Internal: Dry, Oil-free Air (may have Trace of Oil and Water)	Loss of Material	General and Pitting Corrosion	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*
D.4.1, D.4.2	Filter	Shell and Access Cover, Closure Bolting	CS	Internal: Exposure to Moist Air with Some Dirt and Possibly Oil.	Loss of Material	General and Pitting Corrosion	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*
D.5.1, D.5.2	Dryer	Shell and Access Cover, Closure Bolting	CS	Moist Air	Loss of Material	General and Pitting Corrosion	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*
D.6.1	Pressure Regulator	Body and Bonnet	CS	Internal: Dry, Oil-free Air (may have Trace of Oil and Water)	Loss of Material	General and Pitting Corrosion	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*	No
Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*	No
Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*	No
Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).	*Same as for the effects of general and pitting corrosion on piping and fittings (D.1.1).*	No

E1 Chemical and Volume Control System (Pressurized Water Reactor)

E1.1 Piping (1500 psig rating)

E1.1.1 Pipe, Fittings and Flanges

E1.1.2 Closure Bolting

E1.2 Piping (150 psig rating)

E1.2.1 Pipe, Fittings and Flanges

E1.2.2 Closure Bolting

E1.3 High-Pressure Valve

E1.3.1 Body and Bonnet

E1.3.2 Closure Bolting

E1.4 Low-Pressure Valve

E1.4.1 Body and Bonnet

E1.4.2 Closure Bolting

E1.5 High-Pressure Pump

E1.5.1 Casing

E1.5.2 Closure Bolting

E1.6 Low-Pressure Pump

E1.6.1 Casing

E1.6.2 Closure Bolting

E1.7 Regenerative Heat Exchanger

E1.7.1 Channel Head and Access Cover

E1.7.2 Tubesheet

E1.7.3 Tubes

E1.7.4 Shell and Access Cover

E1.7.5 Closure Bolting

E1.8 Letdown Heat Exchanger

E1.8.1 Channel Head and Access Cover

E1.8.2 Tubesheet

E1.8.3 Tubes

E1.8.4 Shell and Access Cover

E1.8.5 Closure Bolting

E1.9 Basket Strainers

E1.9.1 Closure Bolting

E1.10 Volume Control Tank

E1.10.1 Closure Bolting

E1.10.2 Shell and Access Cover

E1.10.3 Nozzle

E1.10.4 Penetration

E1. Chemical and Volume Control System (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the pressurized water reactor (PWR) chemical and volume control system (CVCS) extending from the isolation valves associated with the reactor coolant pressure boundary (and Code change as discussed below in the last two sentences of this paragraph), to the volume control tank and consists of high- and low-pressure piping and valves including the containment isolation valves, regenerative and letdown heat exchangers, pumps, basket strainers, and volume control tank. The system contains chemically treated borated water; the shell side of the letdown heat exchanger contains closed-cycle cooling water (treated water). The effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water and, therefore, are not included in this table. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the CVCS are classified as Group C Quality Standards. Portions of the CVCS extending from the reactor coolant system up to and including the isolation valves associated with reactor coolant pressure boundary are classified as Group A Quality Standard and are covered in Table IV C2.

The pumps and valve internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the chemical and volume control system include the reactor coolant system (Table IV C2), emergency core cooling system (Table V D1), spent fuel pool cooling system (Table VII A3), and closed cycle cooling water system (Table VII C2).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.1.1 E1.1.2	High Pressure Piping (1500 psig rating)	Pipe, Fittings, and Flanges, Closure Bolting	Pipe, Fittings, and Flanges: Stainless Steel (SS)/ Closure Bolting: Low-Alloy Steel (LAS), Carbon Steel (CS)	Chemically Treated Borated Water up to 340°C (644°F)	Cumulative Fatigue Damage	Fatigue	Design Code of Record or later approved Codes.
E1.1.2	High Pressure Piping (1500 psig rating)	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion (BAC)	NRC GL 88-05. ASME Section XI, 1989 or later edition as approved in 10 CFR 50.55a. NRC IN 86–108.
E1.2.2	Low Pressure Piping (150 psig rating)	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*
E1.2.1	Low Pressure Piping (150 psig rating)	Pipe, Fittings, and Flanges (with heat trace cement) (External Surface)	SS	Exterior Surfaces: For Component Fastened with Heat Trace Cement, Held up to 100°C (212°F).	Crack Initiation and Growth	Stress Corrosion Cracking	-
E1.3.1 E1.3.2	High Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Body and Bonnet, Closure Bolting	Body and Bonnet: SS/ Closure Bolting: CS, LAS	Chemically Treated Borated Water up to 340°C (644°F).	Cumulative Fatigue Damage	Fatigue	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).*
E1.3.2	High Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Components have been designed or evaluated for fatigue for a 40 y design life based on postulated cycles, according to the requirements of the Code of record or later approved Codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See Standard Review Plan Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
The AMP relies on implementation of NRC GL 88-05 and inservice inspection (ISI) in conformance with ASME XI (1989 edition or later edition as approved in 10 CFR 50.55a), Subsections IWD, Table IWD 2500-1 to monitor the condition of the reactor coolant pressure boundary for occurrence of borated water leakage.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M5 "Boric Acid Corrosion."	No
Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*	No
Plant-specific aging management program.	Plant-specific aging management is to be further evaluated.	Yes, plant-specific
Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).*	Yes TLAA
Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.4.1	Low Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Body and Bonnet (External Surface)	Stainless Steel (SS)	Exterior Surfaces: For Component Fastened with Heat Trace Cement, Held up to 100°C (212°F).	Crack Initiation and Growth	Stress Corrosion Cracking	-
E1.4.2	Low Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Closure Bolting	Low-Alloy Steel (LAS), Carbon Steel (CS)	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion (BAC)	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*
E1.5.1 E1.5.2 E1.6.1 E1.6.2	High Pressure Pump Low Pressure Pump	Casing, Closure Bolting	Casing: SS, Closure Bolting: CS, LAS	Chemically Treated Borated	Cumulative Fatigue Damage	Fatigue	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).*
E1.5.2	High Pressure Pump	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*
E1.6.1 E1.6.2	Low Pressure Pump	Casing, Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*
E1.7.1 through E1.7.5	Regenerative Heat Exchanger	Channel Head (including Channel Weld) and Cover, Tubesheet, Tubes, Shell, and Closure Bolting	SS, Closure Bolting (LAS, CS)	Tube and Shell Side: Chemically Treated Borated Water up to 340°C (644°F)	Cumulative Fatigue Damage	Fatigue	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).*
E1.7.5	Regenerative Heat Exchanger	Closure Bolting	LAS, CS	Both Sides: Chemically Treated Borated Water up to 340°C (644 °F)	Loss of Material	BAC	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management is to be further evaluated.	Yes, plant-specific
Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*	No
Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).*	Yes TLAA
Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*	No
Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure bolting for high pressure piping (E1.1.2).*	No
Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).*	Yes TLAA
Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting (E1.1.2).*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.7.1 through E1.7.4	Regenerative Heat Exchanger	Channel Head (including Channel Weld) and Cover, Tubesheet, Tubes, and Shell.	LAS, CS	Both Sides: Chemically Treated Borated Water up to 340°C (644 °F)	Crack Initiation and Growth	SCC, Unantici-pated cyclic loading	-
E1.8.1 through E1.8.5	Letdown Heat Exchanger (Serviced by Closed-Cycle Cooling Water)	Channel Head (including Channel Weld) and Cover, Tubesheet, Tubes	Stainless Steel (SS), Carbon Steel (CS)	Tube Side: Chemically Treated Borated Water up to 340°C (644°F); Shell Side: Closed-Cycle Cooling Water (Treated Water)	Cumulative Fatigue Damage	Fatigue	Design Code of Record or later approved Codes
E1.8.1 through E1.8.3	Letdown Heat Exchanger (Serviced by Closed-Cycle Cooling Water)	Channel Head (including Channel Weld) and Cover, Tubesheet, Tubes	SS	Tube Side: Chemically Treated Borated Water up to 340°C (644°F); Shell Side: Closed-Cycle Cooling Water (Treated Water)	Crack Initiation and Growth	SCC, Unantici-pated cyclic loading	-
E1.8.4	Letdown Heat Exchanger (Serviced by Closed-Cycle Cooling Water)	Shell	CS	Closed-Cycle Cooling Water (Treated Water)	Loss of Material	Pitting and Crevice Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, S1. EPRI TR-107396.
E1.8.5	Letdown Heat Exchanger (Serviced by Closed-Cycle Cooling Water)	Closure Bolting	Low-Alloy Steel (LAS), CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	*Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management is to be further evaluated.	Yes, plant-specific
Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting E1.1.2).	*Same as for the effect of fatigue on pipe, fittings, and flanges (E1.1.1) and closure bolting E1.1.2).*	Yes TLAA
Plant-specific aging management program.	Plant-specific aging management is to be further evaluated.	Yes, plant-specific
The program relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI TR–107396 for closed–cycle cooling water (CCCW) systems, and performance and functional testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their function acceptably.	For the evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4 "Closed–Cycle Cooling Water System."	No
Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.9.1	Basket Strainer	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion (BAC)	*Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).*
E1.10.1	Volume Control Tank	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	BAC	*Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).*
E1.10.2 through E1.10.4	Volume Control Tank	Shell and Access Cover, Nozzle, Penetration	CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Pitting and Crevice Corrosion	*Same as for the effect of pitting and crevice corrosion on shell (E1.8.4).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).*	No
Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).	*Same as for the effect of boric acid corrosion on closure Bolting for high pressure piping (E1.1.2).*	No
Same as for the effect of pitting and crevice corrosion on shell (E1.8.4).	*Same as for the effect of pitting and crevice corrosion on shell (E1.8.4).*	No

E2 Standby Liquid Control System (Boiling Water Reactor)

E2.1 Piping

E2.1.1 Piping and Fittings

E2.2 Solution Storage

E2.2.1 Tank

E2.2.2 Tank Heaters

E2.3 Valves (Pump Suction, Relief, Injection, Containment Isolation, and Explosive Actuated Discharge Valves)

E2.3.1 Body and Bonnet

E2.4 Injection Pumps

E2.4.1 Casing

E2. Standby Liquid Control System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the standby liquid control (SLC) system extending from the containment isolation valve to the solution storage tank. The system serves as a backup reactivity control system in all boiling water reactors (BWRs). The major components of this system are the piping, solution storage tank, solution storage tank heaters, valves, and pumps. All of the components from the storage tank to the explosive actuated discharge valve operate in contact with a sodium pentaborate ($Na_2B_{10}O_{16}\bullet 10H_2O$) solution and the piping from the explosive actuated discharge valve to the containment isolation valve contains reactor water. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the standby liquid control system are classified as Group B Quality Standards. The portions of the standby liquid control system extending from the reactor coolant pressure boundary up to and including the containment isolation valves are classified within the Group A Quality Standard and are covered in Table IV C1.

The pumps and valve internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The system that interfaces with the standby liquid control system is the BWR reactor pressure vessel (Table IV.A1). If used, the standby liquid control system would inject sodium pentaborate solution into the pressure vessel near the bottom of the reactor core. Reactor coolant pressure boundary (BWR) (IV.C1)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E2.1.1	Piping	Piping and Fittings in Contact with Sodium Pentaborate Solution	Stainless Steel (SS)	Sodium Pentaborate Solution at 70-90°C (158-194°F) (5000 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 or later edition as approved in 10 CFR 50.55a. NRC RG 1.44. EPRI TR-103515. NUREG/CR-6001. Plant Technical Specifications.
E 2.1.1	Piping	Piping and Fittings in Contact with Reactor Coolant (between Explosive Actuated Discharge Valves and Containment Isolation Valve)	SS	Oxygenated Water	Crack Initiation and Growth	SCC	-

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The Aging Management Program is based on inservice inspection in conformance with ASME Section XI (1989 or later edition as approved in 10 CFR 50.55a), Subsection IWC, Table IWC 2500-1. The control of sodium pentaborate solution is covered by plant technical specifications.	***(1)Scope of Program:*** The program relies on inservice inspection (ISI) to monitor the effects of SCC on the intended function of components. If sodium pentaborate level remains constant as specified, then ISI in accordance with ASME Section XI (1989 or later edition as approved in 10 CFR 50.55a) is adequate. ***(2) Preventive Actions:*** The control of sodium pentaborate solution is covered by plant technical specifications. ***(3) Parameters Monitored/Inspected:*** The parameter monitored is the concentration of sodium pentaborate in the water to reduce the potential for SCC. Inspection requirements of IWC 2500-1 specify periodic volumetric or surface examination of welds in Class 2 components in accordance with Category C-A for pressure vessels, C-F-1 for SS or high-alloy piping and C-G for pumps and valves. ***(4) Detection of Aging Effects:*** Degradation of the piping due to SCC can not occur without crack initiation; the extent and schedule of inspection assure detection of cracks or coolant leakage before the loss of the intended function of the component. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWC-2400 should provide timely detection of cracks. ***(6) Acceptance Criteria:*** Any degradation is evaluated in accordance with IWC-3100 by comparing ISI results with acceptance standards of IWC-3400. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWC-3133. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with 10 CFR 50 Appendix B and will continue to be adequate for the period of license renewal. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing confirmation process and administrative controls. ***(10) Operating Experience:*** No occurrence of SCC in piping and other components in standby liquid control systems has ever been reported (NUREG/CR-6001).	No
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E2.2.1, E2.2.2	Solution Storage	Tank and Tank Heaters	SS	Sodium Pentaborate Solution at 70-150°C (158-302°F) (1100 ppm B)	Crack Initiation and Growth	SCC	*Same as for the effects of SCC on piping and fittings in contact with sodium pentaborate solution (E2.1.1).*
E2.3.1	Valves (Pump Suction, Relief, Injection, Containment Isolation, and Explosive Actuated Discharge Valves)	Body and Bonnet	Stainless Steel (SS)	Sodium Penta-borate Solution at 70-90°C (158-194°F) (1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 or later edition as approved in 10 CFR 50.55a. NRC RG 1.44. EPRI TR-103515. NUREG/CR-6001. Plant Technical Specifications.
E2.4.1	Injection Pumps	Casing	SS	Sodium Penta-borate Solution at 70-90°C (158-194°F) (1100 ppm B)	Crack Initiation and Growth	SCC	*Same as for the effects of SCC on piping and fittings in contact with sodium pentaborate solution (E2.1.1).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effects of SCC on piping and fittings in contact with sodium pentaborate solution (E2.1.1).	*Same as for the effects of SCC on piping and fittings in contact with sodium pentaborate solution (E2.1.1).*	No
Same as for the effects of SCC on piping and fittings in contact with sodium pentaborate solution (E2.1.1).	*Same as for the effects of SCC on piping and fittings in contact with sodium pentaborate solution (E2.1.1).*	No
Same as for the effects of SCC on cracking of internal surfaces of piping (E2.1.1).	*Same as for the effects of SCC on piping and fittings in contact with sodium pentaborate solution (E2.1.1).*	No

E3. Reactor Water Cleanup System (BWRs)

E3.1 Piping

E3.1.1 Piping and Fittings (Beyond Second Isolation Valves)

E3.2 Reactor Water Cleanup (RWCU) Pump

E3.2.1 Casing

E3.2.2 Closure Bolting

E3.3 Regenerative Heat Exchanger

E3.3.1 Channel Head and Access Cover

E3.3.2 Tubesheet

E3.3.3 Tubes

E3.3.4 Shell and Access Cover

E3.4 Non-Regenerative Heat Exchanger

E3.4.1 Channel Head and Access Cover

E3.4.2 Tubesheet

E3.4.3 Tubes

E3.4.4 Shell and Access Cover

E3. Reactor Water Cleanup System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the reactor water cleanup (RWCU) system, which provides for cleanup and particulate removal from the recirculating reactor coolant in all boiling water reactors (BWRs). Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” the portion of the RWCU system extending from the reactor coolant recirculation system up to and including the containment isolation valves forms the primary pressure boundary, and is classified as Group A Quality Standard and is covered in Table IV C1. The remainder of the system outboard of the isolation valves is Quality Group "C." In this table, only RWCU related piping and components outboard of the isolation valves are reviewed. The aging management program for containment isolation valves in the reactor water cleanup system is reviewed in Table IV C1 concerning the reactor coolant pressure boundary in BWRs.

The pumps and valve internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the BWR reactor water cleanup system include the reactor coolant pressure boundary (Table IV C1), the closed cycle cooling water system (Table VII C2), and the condensate system (table VIII E).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E3.1.1	Piping	Piping and Fittings (Beyond Second Isolation Valve)	Stainless Steel (SS): Types 304, 316, or 316NG	Oxygenated Water >93°C (200°F)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC), Inter-granular Stress Corrosion Cracking (IGSCC)	NRC Inspection Criteria for RWCU Piping. NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S1 BWRVIP-29.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Based on the NRC criteria related to inspection guidelines for reactor water cleanup (RWCU) piping welds outboard of the second isolation valve, the program recommends measures delineated in NUREG-0313, Rev. 2 and NRC Generic letter (GL) 88-01, and inservice inspection in conformance with ASME Section XI (1989 or later edition as approved in 10 CFR 50.55a), Subsection IWC 2500-1. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 (TR-103515) to minimize the potential of crack initiation and growth.	***(1) Scope of Program:*** Based on the NRC criteria related to inspection guidelines for RWCU piping welds outboard of the second isolation valve, the program recommends measures delineated in NUREG-0313, Rev. 2 and NRC GL 88-01 to monitor IGSCC and its effects on the intended function of austenitic stainless steel (SS) piping. The inspection criteria include: (a) satisfactory completion of all NRC GL 89-10 required actions, (b) no detection of IGSCC in RWCU welds inboard of the second isolation valves (on-going GL 88-01 inspection), and (c) no detection of IGSCC in RWCU welds outboard of the second isolation valves after inspecting a minimum of 10% of the susceptible piping. No IGSCC inspection is recommended for plants that meet all three criteria or that meet criterion (a) and piping is made of material that is resistant to IGSCC. ***(2) Preventive Actions:*** Based on NUREG-0313, mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of austenitic SSs and weld metal, with a maximum carbon of 0.03% and minimum 7.5% ferrite in weld metal, and by special processing such as solution heat treatment, heat sink welding, and induction heating or mechanical stress improvement. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 to minimize the potential of crack initiation and growth. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors IGSCC of austenitic SS piping by detection and sizing of cracks by implementing the inspection guidelines delineated in the NRC inspection criteria for RWCU piping outboard of isolation valves. The following schedules are followed: Schedule A, no inspection is required for plants that either meet all three criteria or if they meet only criterion (a), piping is made of material that is resistant to IGSCC. Schedule B, for plants that meet only criterion (a), inspect at least 2% of the welds or 2 welds every refueling outage, whichever sample is larger. Schedule C, plants that do not meet criterion (a), inspect at least 10% of the welds every refueling outage. Guidelines for inspection schedule, methods, personnel, sample expansion, and leak detection guidelines are based on the guidelines of GL 88-01. ***(4) Detection of Aging Effects:*** Aging degradation of the piping can not occur without crack initiation and growth; extent and schedule of inspection as delineated in the NRC inspection criteria for RWCU piping is adequate and assures timely detection of cracks before the loss of intended function of austenitic SS piping and fittings. ***(5) Monitoring and Trending:*** Inspection schedule and sample size specified in the NRC inspection criteria for RWCU piping are adequate for timely detection of cracks. If IGSCC was found during inspection, the sample expansion and methods of mitigation including replacement should be discussed with the NRC staff. ***(6) Acceptance Criteria:*** Any IGSCC degradation is evaluated in accordance with IWB-3100 by comparing ISI results with the acceptance	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E3.1.1	Piping	Piping and Fittings (Beyond Second Isolation Valve)	SS, Types 304, 316, or 316NG	Oxygenated Water >93°C (200°F)	Cumulative Fatigue Damage	Fatigue	Design Code of Record or Later Approved Codes.
E3.2.1	Reactor Water Cleanup (RWCU) Pump	Casing	Cast Austenitic Stainless Steel (CASS)	Oxygenated Water up to 288°C (550°F)	Crack Initiation and Growth	SCC, IGSCC	*Same as for the effect of Stress Corrosion Cracking on Item E3.1.1 piping and fittings beyond the second isolation valve.*
E3.2.1	RWCU Pump	Casing	CASS, Stainless Steel (SS)	Oxygenated Water up to 288°C (550°F)	Cumulative Fatigue Damage	Fatigue	Design Code of Record or Later Approved Codes.
E3.2.2	RWCU Pump	Closure Bolting	HSLAS	Air, Leaking Oxygenated Water	Loss of Preload	Stress Relaxation	NUREG-1339. EPRI NP-5769. EPRI NP-5067. ASME Section XI, 1989 or later edition as approved in 10 CFR 50.55a. NRC GL 91-17. IEB 82-02.
E3.2.2	RWCU Pump	Closure Bolting	HSLAS	Air, Leaking Oxygenated Water	Cumulative Fatigue Damage	Fatigue	Design Code of Record or later approved Codes.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) standards of IWC-3400 and IWC-3500. ***(7) Corrective Actions:*** Repair is in conformance with IWA-4000 and IWB-4000 or GL 88-01. Continued operation without repair requires that crack growth calculation be performed according to the guidance of GL 88-01 or other approved procedures. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing confirmation process and administrative controls. ***(10) Operating Experience:*** IGSCC has occurred in small- and large-diameter BWR piping made of austenitic SSs or nickel alloys.	
Components have been designed or evaluated for fatigue for a 40 y design life based on postulated cycles, according to the requirements of the Code of record or later approved Codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
Same as for the effect of Stress Corrosion Cracking on Item E3.1.1 piping and fittings beyond the second isolation valve.	*Same as for the effect of Stress Corrosion Cracking on Item E3.1.1 piping and fittings beyond the second isolation valve.*	No
Components have been designed or evaluated for fatigue for a 40 y design life based on postulated cycles, according to the requirements of the Code of record or later approved Codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See Standard Review Plan Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA
The program relies on recommendations for a comprehensive bolting integrity program delineated in NUREG–1339 and industry's recommendations delineated in EPRI NP-5769, with the exceptions noted in NUREG 1339, for safety related bolting, and EPRI NP-5067 for other bolting.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M12 "Bolting Integrity."	No
Components have been designed or evaluated for fatigue for a 40 y design life based on postulated cycles, according to the requirements of the Code of record or later approved Codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See Standard Review Plan Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E3.3.1 through E3.3.4	Regenerative Heat Exchanger	Channel Head and Access Cover, Tubesheet, Tubes, Shell and Access Cover	Channel Head and Access Cover, Tubesheet, Tubes: Stainless Steel (SS)/ Shell and Access Cover: High Strength Low-Alloy Steel (HSLAS) with SS Cladding	Oxygenated Water at 288°C (550°F) and 10 MPa Max.	Crack Initiation and Growth	SCC, Cyclic Loading	-
E3.4.1 through E3.4.4	Non-Regenerative Heat Exchanger (Serviced by Closed-Cycle Cooling Water, CCCW)	Channel Head and Access Cover, Tubesheet, Tubes, Shell and Access Cover	Channel Head and Access Cover, Tubesheet, Tubes: Stainless Steel (SS)/ Shell and Access Cover: HSLAS with SS Cladding	Reactor Coolant Water at 288°C (550°F) and 10 MPa Max.	Crack Initiation and Growth	SCC, Cyclic Loading	-
E3.4.4	Non-Regenerative Heat Exchanger (Serviced by CCCW)	Tubes, Shell and Access Cover	Tubes: SS/ Shell and Access Cover: HSLAS with SS Cladding	Reactor Coolant Water at 10 MPa Max.	Loss of Material	MIC	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, S1. EPRI TR-107396.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management is to be further evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management is to be further evaluated.	Yes, plant-specific
The program relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI TR–107396 for closed–cycle cooling water (CCCW) systems, and performance and functional testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their functions acceptably.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4 "Closed–Cycle Cooling Water System."	No

E4. Shutdown Cooling System (Older BWR)

E4.1 Piping

E4.1.1 Piping and Fittings

E4.2 Pump

E4.2.1 Casing

E4.3 Valves

E4.3.1 Body and Bonnet

E4.4 Heat Exchanger

E4.4.1 Channel Head and Access Cover

E4.4.2 Tubesheet

E4.4.3 Tubes

E4.4.4 Shell and Access Cover

E4. Shutdown Cooling System (Older BWR)

System, Structures, and Components

The system, structures, and components included in this table comprise the shut-down cooling (SDC) system for the older vintage boiling water reactors (BWRs) and consist of piping and fittings, SDC system pump, heat exchanger, and valves. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the SDC system are classified as Group B Quality Standards. Portions of the shutdown cooling system extending from the reactor coolant pressure boundary up to and including the containment isolation valves are classified as Group A Quality Standard and are covered in Table IV C1.

The pumps and valve internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the SDC system include the reactor coolant pressure boundary (Table IV C1) and closed cycle cooling water system (Table VII C2).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E4.1.1	Piping	Piping and Fittings	Carbon Steel (CS), Stainless Steel (SS)	Reactor Coolant Water, Up to 288°C (550°F)	Loss of Material	Pitting and Crevice Corrosion	EPRI TR-103515.
E4.1.1	Piping	Piping and Fittings	CS, SS	Oxygenated Water, Up to 288°C (550°F)	Cumulative Fatigue Damage	Fatigue	Design Code of Record or Later Approved Codes.
E4.1.1	Piping	Piping and Fittings	SS	Oxygenated Water, Up to 288°C (550°F)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, Suppl. 1. ASME Section XI, 1989 or Later Edition as Approved in 10 CFR 50.55a. BWRVIP-29 (EPRI TR-103515).

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on the water chemistry program which consists of monitoring and control of water chemistry based on EPRI guidelines of TR-103515 for water chemistry in BWRs to manage the effects of loss of material due to crevice or pitting corrosion. However, crevice or pitting corrosion may occur at locations of stagnant flow conditions, and verification of the effectiveness of the chemistry control program should ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. An acceptable verification program consists of a one-time inspection of select component and susceptible locations in the system.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M11, "Water Chemistry."	Yes, detection of aging effects should be further evaluated
Components have been designed or evaluated for fatigue for a 40 y design life based on postulated cycles, according to the requirements of the Code of record or later approved Codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See Standard Review Plan Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes TLAA
Aging Management Program delineated in NUREG-0313, Rev. 2 and measures recommended in NRC Generic letter (GL) 88-01 and its Supplement 1, and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1. Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 (TR-103515) to minimize the potential of crack initiation and growth.	***(1) Scope of Program:*** The program focuses on managing the effects of IGSCC on the intended function of austenitic stainless steel (SS) piping 4 in. or larger in diameter and containing reactor water above 93°C (200°F) during power operation regardless of Code classification. It also applies to reactor vessel attachments and appurtenances. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selecting material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of austenitic SSs and weld metal, with a maximum carbon of 0.03% and minimum 7.5% ferrite in weld metal, and by special processing such as solution heat treatment, heat sink welding, and induction heating or mechanical stress improvement (SI). Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and growth. Hydrogen water chemistry and stringent control of conductivity is also used to inhibit IGSCC. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of IGSCC on the intended function of primary coolant system piping by detecting and sizing cracks by inservice inspection (ISI) in accordance with the guidelines of ASME Section XI Table IWC 2500-1 and GL 88-01. Examination category C-F-1, specifies for circumferential and longitudinal welds in each pipe or branch run NPS 4 or larger, volumetric and surface examination of ID region extending 1/4 in. on either side of the weld and 1/3 wall thickness deep, and surface examination of OD surface extending 1/2 in. on either side. Surface examination is conducted for circumferential	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) and longitudinal welds in each pipe or branch run less than NPS 4. For socket welds, surface examination is specified of OD surface extending 1 in. on the buttered side and 1/2 in. on the other. Inspection requirements of testing category C-H specify visual VT-2 (IWA-5240) examination of all pressure retaining Class 2 components during system leakage test (IWB-5221) and system hydrostatic test (IWB-5222). Leakage detection is in conformance with Position C of Regulatory Guide 1.45. ***(4) Detection of Aging Effects:*** Aging degradation of the piping can not occur without crack initiation; extent and schedule of inspection as delineated in GL 88-01 is adequate and assure detection of cracks before the loss of intended function of austenitic SS piping and fittings. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI provides for timely detection of cracks. Inspection schedule and sample size specified in Table 1 of GL 88-01 are based on the condition of each weld and are adequate for timely detection of cracks. Welds of resistant material are as a minimum examined according to an extent and frequency comparable to those of ASME Section XI, e.g., 25% are examined every 10 y, at least 12% in 6 y. Inspection extent and schedule are enhanced for welds of non-resistant materials, or welds that have been treated by SI or reinforced by weld overlay. ***(6) Acceptance Criteria:*** Any IGSCC degradation is evaluated in accordance with IWB-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3514. Planar and liner flaws are sized according to IWA-3300 and IWA-3400. Guidance for flaw evaluation are provided in GL88-01. ***(7) Corrective Actions:*** Repair and reexaminations are in conformance with IWA-4000 or GL 88-01. Repair methods include weld overlay reinforcement or partial replacement. Approved clamping devices may be used for temporary reinforcement of cracked weldments. SI is considered effective mitigation for short and shallow cracks, e.g., not longer than 10% of circumference and not deeper than 30% of wall thickness. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance to 10 CFR 50 Appendix B and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** IGSCC has occurred in small- and large-diameter BWR piping made of austenitic SSs. Significant cracking has occurred in RHR system and reactor water cleanup system piping welds. The AMP outlined in NUREG-0313 and GL 88-01 is based on substantial effort in research and development, and industry recommendations developed in response to NRC communications. The program addresses improvements in the three elements that cause IGSCC, e.g., a susceptible (sensitized) material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring structural integrity of the shutdown cooling system.	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E4.2.1	Pump	Casing	Carbon Steel (CS)	Oxygenated Water, Up to 288°C (550°F)	Loss of Material	Pitting and Crevice Corrosion	*Same as for the effect of pitting and crevice corrosion on piping and fittings (E4.1.1)*
E4.3.1	Valves (Check, Control, Hand, Motor Operated, & Relief Valves)	Body and Bonnet	SS Forging, SS Casting	Oxygenated Water, Up to 288°C (550°F)	Crack Initiation and Growth	SCC	ASME Section XI, 1989 or later edition as Approved in 10 CFR 50.55a. NUREG-0313, Rev. 2. NRC GL 88-01, & Suppl. 1. NRC GL 89-04. NRC GL 96-05. NRC IN 88-70, BWRVIP-29 (EPRI TR-103515).

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effect of crevice and pitting corrosion on piping and fitting (E4.1.1).	*Same as for the effect of crevice and pitting corrosion on piping and fitting (E4.1.1). See Chapter XI.M11, "Water Chemistry."*	Yes, detection of aging effects should be further evaluated
Guidelines of NUREG-0313, Rev. 2 and NRC Generic letter (GL) 88-01 and its Supplement 1; and based on plant technical specifications, inservice inspection in conformance with ASME Section XI (1989 or later edition as approved in 10 CFR 50.55a), Table IWC 2500-1. Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and growth.	***(1) Scope of Program:*** The program includes preventive measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on intended function of the valves. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of cast SSs and weld metal, with maximum 0.03% carbon and minimum 7.5% ferrite. Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and growth. Hydrogen water chemistry and stringent control of conductivity is used to inhibit IGSCC. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on intended function of the valves by detection and sizing of cracks by ISI in accordance with the guidelines of ASME Section XI, Table IWC 2500-1 and GL 88-01. Inspection requirements of Table IWC 2500-1 for Class 2 valves, category C-G specifies for all valves in each piping run examined under category C-F-1, surface examination of either the inside or outside surface of all welds extending 1/2 in. on either side of the weld. In a group of multiple valves of similar design, size, function, and service, examination of only one valve is required. ***(4) Detection of Aging Effects:*** Degradation of valves due to SCC can not occur without crack initiation or degradation of pump performance; ISI schedule as delineated in GL 88-01 is adequate and assures detection of cracks or degradation of valve performance before the loss of intended function. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWC-2400 should provide timely detection of cracks. All welds are inspected each inspection period from at least one valve in each group with similar design and performing similar functions in the system. Visual examination is required only when the valve is disassembled for maintenance, repair, or volumetric examination, but at least once during the period. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3515. ***(7) Corrective Actions:*** Repair and	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E4.4.1 through E4.4.4	Heat Exchanger (Serviced by Closed-Cycle Cooling Water System)	Channel Head and Access Cover, Tubesheet, Tubes, Shell and Access Cover	Channel Head and Access Cover: CS/ Tubesheet: CS (SS Cladding on Channel Side)/ Tubes: SS/ Shell: CS	Reactor Coolant Water; and Treated Component (Closed Cycle) Cooling Water	Loss of Material	Pitting, Crevice and Microbio-logically Influenced Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) replacement are in conformance with IWA-4000. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing confirmation process and administrative controls. ***(10) Operating Experience:*** The comprehensive AMP outlined in NUREG-0313 and GL 88-01 addresses improvements in all three elements that cause SCC, e.g., a susceptible material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring structural integrity of BWR components.	No
The program relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI TR–107396 for closed–cycle cooling water (CCCW) systems, and performance and functional testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their functions acceptably.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4 "Closed Cycle Cooling Water System."	No

F1. Control Room Area Ventilation System

F1.1 Duct

F1.1.1 Duct, Fittings, Access Doors, and Closure Bolts

F1.1.2 Equipment Frames and Housing

F1.1.3 Flexible Collars between Ducts and Fans

F1.1.4 Seals in Dampers and Doors

F1.2 Air Handler Heating/Cooling

F1.2.1 Heating/Cooling Coils

F1.3 Piping

F1.3.1 Piping and Fittings

F1.4 Filters

F1.4.1 Housing and Supports

F1.4.2 Charcoal Absorber Filter

F1.4.3 Elastomer Seals

F1. Control Room Area Ventilation System

System, Structures, and Components

The system, structures, and components included in this table comprise the control room area ventilation system (with warm moist air as normal environment) which contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, filters and heating and cooling air handlers. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the control room area ventilation system are classified as Group B Quality Standards.

System Interfaces

The system that interface with the control room area ventilation system is the auxiliary and radwaste area ventilation system (Table VII F2).

VII AUXILIARY SYSTEMS
F1. CONTROL ROOM AREA VENTILATION SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F1.1.1 F1.1.2	Duct	Fittings, Access Doors, and Closure Bolts; Equipment Frames and Housing,	Carbon Steel (CS) (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Microbio-logically-Influenced, Pitting, and Crevice Corrosion	-
F1.1.3 F1.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degrada-tion From Heating and Radiation	-
F1.1.3 F1.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Loss of Material	Wear	-
F1.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Microbiolog ically-Influenced, Pitting, and Crevice Corrosion	-
F1.3.1	Piping	Piping and Fittings	CS	Hot or Cold Treated Water	Loss of Material	General, Microbiolog ically-Influenced, Pitting, and Crevice Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.
F1.4.1	Filters	Housing and Supports	CS, Stainless Steel	Warm, Moist Air	Loss of Material	General, Microbiolog ically-Influenced, Pitting, and Crevice Corrosion	-
F1.4.2	Filters	Charcoal Absorber Filter	Activated Charcoal	Warm, Moist Air	Loss of Iodine Retention Capacity	Absorption of Moisture	-
F1.4.3	Filters	Elastomer Seals	Elastomers (neoprene and similar materials)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degra-dation	-

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
For description of the AMP, see Chapter XI.M4, "Closed Cycle Cooling Water System."	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4, "Closed Cycle Cooling Water System."	No
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific

F2. Auxiliary and Radwaste Area Ventilation System

F2.1 Duct

F2.1.1 Duct, Fittings, Access Doors and Closure Bolts

F2.1.2 Equipment Frames and Housing

F2.1.3 Flexible Collars between Ducts and Fans

F2.1.4 Seals in Dampers and Doors

F2.2 Air Handler Heating/Cooling

F2.2.1 Heating/Cooling Coils

F2.3 Piping

F2.3.1 Piping and Fittings

F2.4 Filters

F2.4.1 Housing and Supports

F2.4.2 Charcoal Absorber Filter

F2.4.3 Elastomer Seals

F2. Auxiliary and Radwaste Area Ventilation System

System, Structures, and Components

The system, structures, and components included in this table comprise the auxiliary and radwaste areas ventilation system (with warm moist air as normal environment) and contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, filters and heating and cooling air handlers. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the auxiliary and radwaste area ventilation system are classified as Group B Quality Standards.

System Interfaces

The systems that interface with the auxiliary and radwaste area ventilation system are the control room area ventilation system (Table VII F1) and diesel generator building ventilation system (Table VII F4).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F2.1.1 F2.1.2	Duct	Duct Fittings, Access Doors, and Closure Bolts; Equipment Frames and Housing	CS (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	-
F2.1.3 F2.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degradation From Heating and Radiation	-
F2.1.3 F2.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Loss of Material	Wear	-
F2.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	-
F2.3.1	Piping	Piping and Fittings	CS	Hot or Cold Treated Water	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.
F2.4.1	Filters	Housing and Supports	CS, Stainless Steel	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	-
F2.4.2	Filters	Charcoal Absorber Filter	Activated Charcoal	Warm, Moist Air	Loss of Iodine Retention Capacity	Absorption of Moisture	-
F2.4.3	Filters	Elastomer Seals	Elastomers (neoprene and similar materials)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degra-dation	-

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
For description of the AMP, see Chapter XI.M4, "Closed Cycle Cooling Water System."	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4, "Closed Cycle Cooling Water System."	No
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific

F3. Primary Containment Heating and Ventilation System

F3.1 Duct

F3.1.1 Duct, Fittings, Access Doors and Closure Bolts

F3.1.2 Equipment Frames and Housing

F3.1.3 Flexible Collars between Ducts and Fans

F3.1.4 Seals in Dampers and Doors

F3.2 Air Handler Heating/Cooling

F3.2.1 Heating/Cooling Coils

F3.3 Piping

F3.3.1 Piping and Fittings

F3.4 Filters

F3.4.1 Housing and Supports

F3.4.2 Charcoal Absorber Filter

F3.4.3 Elastomer Seals

F3. Primary Containment Heating and Ventilation System

System, Structures, and Components

The system, structures, and components included in this table comprise the primary containment heating and ventilation system (with warm moist air as normal environment) which contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, filters and heating and cooling air handlers. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the primary containment heating and ventilation system are classified as Group C Quality Standards.

System Interfaces

The systems that interface with the primary containment heating and ventilation system are the closed cycle cooling water system (Table VII C2) and the PWR and BWR containments (Table II A and Table II B, respectively).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F3.1.1 F3.1.2	Duct	Duct Fittings, Access Doors and Closure Bolts; Equipment Frames and Housing	CS (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	-
F3.1.3 F3.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degradation From Heating and Radiation	-
F3.1.3 F3.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Loss of Material	Wear	-
F3.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	-
F3.3.1	Piping	Piping and Fittings	CS	Hot or Cold Treated Water	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.
F3.4.1	Filters	Housing and Supports	CS, Stainless Steel	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	-
F3.4.2	Filters	Charcoal Absorber Filter	Activated Charcoal	Warm, Moist Air	Loss of Iodine Retention Capacity	Absorption of Moisture	-
F3.4.3	Filters	Elastomer Seals	Elastomers (neoprene and similar materials)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degra-dation	-

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
For description of the AMP, see Chapter XI.M4, "Closed Cycle Cooling Water System."	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4, "Closed Cycle Cooling Water System."	No
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant-specific

F4. Diesel Generator Building Ventilation System

F4.1 Duct

F4.1.1 Duct, Fittings, Access Doors and Closure Bolts

F4.1.2 Equipment Frames and Housing

F4.1.3 Flexible Collars between Ducts and Fans

F4.1.4 Seals in Dampers and Doors

F4.2 Air Handler Heating/Cooling

F4.2.1 Heating/Cooling Coils

F4.3 Piping

F4.3.1 Piping and Fittings

F4. Diesel Generator Building Ventilation System

System, Structures, and Components

The system, structures, and components included in this table comprise the diesel generator building ventilation system (with warm moist air as normal environment) which contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, and heating and cooling air handlers. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the diesel generator building ventilation system are classified as Group C Quality Standards.

System Interfaces

The system that interface with the diesel generator building system is the auxiliary and radwaste area ventilation system (Table VII F2).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F4.1.1 F4.1.2	Duct	Duct Fittings, Access Doors, and Closure Bolts; Equipment Frames and Housing	CS (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	-
F4.1.3 F4.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degradation From Heating and Radiation	-
F4.1.3 F4.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Loss of Material	Wear	-
F4.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	-
F4.3.1	Piping	Piping and Fittings	CS	Hot or Cold Treated Water	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific Aging Management Program.	Plant-specific Aging Management Program is to be evaluated.	Yes, plant-specific
Plant-specific Aging Management Program.	Plant-specific Aging Management Program is to be evaluated.	Yes, plant-specific
Plant-specific Aging Management Program.	Plant-specific Aging Management Program is to be evaluated.	Yes, plant-specific
Plant-specific Aging Management Program.	Plant-specific Aging Management Program is to be evaluated.	Yes, plant-specific
The AMP relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI TR–107396 for closed–cycle cooling water (CCCW) systems, and performance and functional testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their function acceptably.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4, “Closed Cycle Cooling Water System.”	No

G. Fire Protection

G.1 Intake Structure

G.1.1 Fire Barrier Penetration Seals

G.1.2 Fire Barrier Walls, Ceiling, and Floors

G.1.3 Fire Rated Doors

G.2 Turbine Building

G.2.1 Fire Barrier Penetration Seals

G.2.2 Fire Barrier Walls, Ceiling, and Floors

G.2.3 Fire Rated Doors

G.3 Auxiliary Building

G.3.1 Fire Barrier Penetration Seals

G.3.2 Fire Barrier Walls, Ceiling, and Floors

G.3.3 Fire Rated Doors

G.4 Diesel Generator Building

G.4.1 Fire Barrier Penetration Seals

G.4.2 Fire Barrier Walls, Ceiling, and Floors

G.4.3 Fire Rated Doors

G.5 Primary Containment

G.5.1 Fire Barrier Walls, Ceiling, and Floors

G.5.2 Fire Rated Doors

G.6 Water-Based Fire Protection System

G.6.1 Piping and Fittings

G.6.2 Filter, Fire Hydrants, Mulsifier, Pump Casing, Sprinkler, Strainer, and Valve Bodies (including containment isolation valves)

G.7 Reactor Coolant Pump Oil Collection System

G.7.1 Tank

G.7.2 Piping, Tubing, Valve Bodies

G.8 Diesel Fire System

G.8.1 Diesel-Driven Fire Pump and Fuel Supply Line

G. Fire Protection

System, Structures, and Components

The system, structure, and components included in this table comprise the fire protection system for both boiling water reactors (BWRs) and pressurized water reactors (PWRs) and consist of several Class 1 structures, mechanical systems, and electrical components. The Class 1 structures include intake structure, turbine building, auxiliary building, diesel generator building, and primary containment, and structural components include fire barrier wall, ceiling, floor, fire door, and penetration seal. Mechanical systems include high pressure service water system, reactor coolant pump oil collect system, and diesel fire system, and mechanical components include piping and fittings, filter, fire hydrant, mulsifier, pump, sprinkler, strainer, and valves (including containment isolation valves). Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all of the mechanical components are classified as Group C Quality Standards.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration, or are subject to replacement based on qualified life or specified time period, and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i and ii).

System Interfaces

The systems that interface with the fire protection system include various Class 1 structures and component supports (Chapter III), electrical system (Table VI), closed cycle cooling water system (Table VII C2) and the diesel fuel oil system (Table VII H1).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.1.1	Intake Structure	Fire Barrier Penetration Seals (for Piping, Electrical Conduit, Cable Tray, Heating, Ventilation, Air Condition, and Expansion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture	Increased Hardness and Shrinkage	Weathering	10 CFR Part 50, Appendix R. NRC BTP 9.5-1 NUREG 0800, Section 9.5-1.
G.1.2	Intake Structure	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	10 CFR Part 50, Appendix R. NRC BTP 9.5-1 NUREG 0800, Section 9.5.1.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
For plants built prior to 1979, as part of the plant fire protection program mandated by 10 CFR Part 50, Appendix R and Branch Technical Position (BTP) 9.5-1, the fire barrier inspection program requires periodic visual inspection of fire barrier penetration seals for signs of seal degradation due to increased hardness or shrinkage leading to cracking, separation from walls or components, rupture or puncture of seal, to ensure that the intended function of the fire barrier penetration is maintained. The inspection should be conducted once every 18 months. Corrective actions should be initiated as necessary. For plants constructed after 1979, the AMP would follow the guidance of NUREG 0800 Section 9.5.1.	***(1) Scope of Program**:* The program is focused on managing the effects of weathering on the intended function of the penetration seals of piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint that perform fire barrier function. ***(2) Preventive Actions:*** Penetration seal provides a fire barrier to confine or retard a fire from spreading by protecting the safety-related systems and components from heat and smoke exposure. Periodic inspection is performed. Degraded penetration seal is repaired or replaced. ***(3) Parameters Monitored/Inspected:*** The visual inspection examines the signs of degradation such as cracking, separation from walls and component, separation of layers of material, rupture and puncture of seal which are directly caused by increased hardness and shrinkage of seal material due to weathering. ***(4) Detection of Aging Effects:*** Visual inspection should detect cracking, separation from walls and component, rupture and puncture of seal. Visual inspection and periodic inspection performed at least once every 18 months should ensure timely detection of increased hardness and shrinkage of the penetration seal before the loss of the component intended function. ***(5) Monitoring and Trending:*** The effects of weathering are detectable by visual inspection and, based on operating experience, inspection performed at least once every 18 months that degradation of the fire barrier penetration seal is detected prior to loss of the intended function. ***(6) Acceptance Criteria:*** No visual indications of cracking, separation from walls and components, or separation of layers of material, or rupture and puncture of seal. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented according to 10 CFR 50 Appendix B requirements and will continue to be adequate for license renewal. ***(10) Operating Experience*:** Operating experience with this AMP has shown that failure of penetration seal due to weathering is insignificant.	No
For plants built prior to 1979, as part of the plant fire protection program mandated by 10 CFR Part 50, Appendix R and Branch Technical Position (BTP) 9.5-1, the fire barrier inspection program requires periodic visual inspection of fire barrier walls, ceilings, and floors, for signs of degradation such as concrete cracking, spalling, and corrosion of reinforcement, to ensure that the intended function of the fire barriers is maintained. The inspection should be conducted once every 18 months. Corrective actions are initiated as necessary. For plants constructed after 1979, the AMP would follow the guidance of NUREG 0800 Section 9.5.1.	***(1) Scope of Program**:* The program is focused on managing the aging effects on the intended function of the fire rated walls, ceilings, and floors that perform fire barrier function. ***(2) Preventive Actions:*** Fire rated walls, ceilings, and floors provide fire barriers to confine or retard a fire from spreading by protecting the safety-related systems and components from flame and heat exposure. Visual inspection is conducted at least every 18 months. Corrective actions are initiated as necessary. ***(3) Parameters Monitored/Inspected:*** The AMP requires visual inspection of the fire rated walls, ceilings, and floors for cracking, spalling, and loss of material which are signs of degradation of the fire rated structural components caused by freeze-thaw, chemical attack, and reaction with aggregates. ***(4) Detection of Aging Effects:*** Visual inspection is an effective method to provide for timely detection of concrete cracking, spalling, and loss of	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.1.2	Intake Structure	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*
G.1.3	Intake Structure	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	10 CFR Part 50, Appendix R. NRC BTP 9.5-1. NUREG 0800, Section 9.5.1.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
(continued from previous page) The AMP also includes Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 [For description of the program see Chapter XI.S6 "Maintenance Rule (10 CFR 50.65 - Structural Monitoring)."]	*(continued from previous page)* material. ***(5) Monitoring and Trending:*** The concrete cracking, spalling, and loss of material are detectable by visual inspection and, based on operating experience, visual inspection performed at least once every 18 months has shown that degradation of the fire barrier walls, ceilings, and floors is detected before there is a loss of the intended function. ***(6) Acceptance Criteria:*** No visual indications of concrete cracking, spalling and loss of material. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience*:** No significant degradation has been found during plant walkdown inspection of the fire barrier structural components. Operating experience with this AMP has shown that degradation of fire barriers is insignificant.	
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
For plants built prior to 1979, as part of the plant fire protection program mandated by 10 CFR Part 50, Appendix R and Branch Technical Position (BTP) 9.5-1, the fire door inspection program requires periodic visual inspection and function test of fire rated doors to maintain their intended functions. Corrective actions are initiated as necessary. For plants constructed after 1979, the AMP would follow the guidance of NUREG 0800 Section 9.5.1.	***(1) Scope of Program****:* The AMP utilizes visual inspection to examine all the fire rated doors (automatic or manual) that perform fire barrier function. ***(2) Preventive Actions:*** The fire rated doors provide fire barriers to confine or retard a fire from spreading by protecting the safety-related systems and components from heat and smoke exposure. Periodic inspection is conducted. Repair or replacement is carried out for the degraded doors. ***(3) Parameters Monitored/Inspected:*** The fire doors are inspected and functionally tested to verify the operability of automatic hold-open, release, closing mechanisms, and latches. Hollow metal fire doors are visually inspected for holes in the skin of the door. ***(4) Detection of Aging Effects:*** Visual inspection is an effective method to detect degradation of the door such as wear and missing part. Function test should promptly detect deficiency of the operation conditions. ***(5) Monitoring and Trending:*** Wear, missing parts or holes in the door are detectable by visual inspection and, based on operating experience, visual inspection and function test performed bi-monthly has shown that degradation of the fire doors is detected prior to loss of the intended function. ***(6) Acceptance Criteria:*** No visual indications of missing part, holes, and wear. No deficiencies in the functional test. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.2.1	Turbine Building	Fire Barrier Penetration Seals (for Piping, Electri-cal Conduit, Cable Tray, Heating, Ventilation, Air Condition, and Expan-sion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture	Increased Hardness and Shrinkage	Weathering	*Same as for Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*
G.2.2	Turbine Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*
G.2.2	Turbine Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*
G.2.3	Turbine Building	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	*Same as for Wear of Item G.1.3 fire barrier doors.*
G.3.1	Auxiliary Building	Fire Barrier Penetration Seals (for Piping, Electrical Conduit, Cable Tray, Heating, Ventilation, Air Condition, & Expansion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture	Increased Hardness and Shrinkage	Weathering	*Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*
G.3.2	Auxiliary Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience*:** Fire doors have experienced wear of the hinges and handles. Operating experience with this AMP has shown that degradation of fire door is insignificant.	
Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.	*Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No
Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.	*Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.3.2	Auxiliary Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*
G.3.3	Auxiliary Building	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	*Same as for Wear of Item G.1.3 fire barrier doors.*
G.4.1	Diesel Generator Building	Fire Barrier Penetration Seals (for Piping, Electrical Conduit, Cable Tray, Heating, Ventilation, Air Condition, & Expansion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture	Increased Hardness and Shrinkage	Weathering	*Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*
G.4.2	Diesel Generator Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*
G.4.2	Diesel Generator Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*
G.4.3	Diesel Generator Building	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	*Same as for Wear of Item G.1.3 fire barrier doors.*
G.5.1	Primary Containment	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor	Concrete Cracking and Spalling	Aggressive Chemical Attack, and Reaction with Aggregates	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*
G.5.1	Primary Containment	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor	Loss of Material	Corrosion of Embedded Steel	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2.*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No
Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.	*Same as for the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.5.2	Primary Containment	Fire Rated Doors	Steel	Indoor	Loss of Material	Wear	*Same as for Wear of Item G.1.3 fire barrier doors.*
G.6.1	Water-Based Fire Protection System	Piping and Fittings	Carbon Steel (CS), Cast Iron, and Stainless Steel (SS)	Raw Water	Loss of Material	General, Galvanic, Microbio-logically-Induced, Pitting, and Crevice Corrosion	NFPA Standards
G.6.1	Water-Based Fire Protection System	Piping and Fittings	CS, Cast Iron, SS	Raw Water	Buildup of Deposit	Biofouling	*Same as for Water Based Fire Protection System of Item G.6.1*
G.6.2	Water-Based Fire Protection System	Filter, Fire Hydrant, Mulsifier, Pump Casing, Sprinkler, Strainer, and Valve Bodies (Including Containment Isolation Valves)	CS, Cast Iron, Bronze, Copper, SS	Raw Water	Loss of Material	General, Galvanic, Microbio-logically-Induced, Pitting, and Crevice Corrosion	*Same as for Water Based Fire Protection System of Item G.6.1*
G.6.2	Water-Based Fire Protection System	Filter, Fire Hydrant, Mulsifier, Pump Casing, Sprinkler, Strainer, and Valve Bodies (Including Containment Isolation Valves)	CS, Cast Iron, Bronze, SS	Raw Water	Buildup of Deposit	Biofouling	*Same as for Water Based Fire Protection System of Item G.6.1*
G.7.1	Reactor Coolant Pump Oil Collection System	Tank	CS	Lubricating Oil	Loss of Material	General, Galvanic, Pitting, and Crevice Corrosion	10 CFR Part 50, Appendix R. NRC BTP 9.5-1 NUREG 0800, Section 9.5.1 NRC IN 94-58.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No
For description of the AMP, see Chapter XI.M10, "Fire Water System."	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M10, "Fire Water System."	No
Same as for Water Based Fire Protection System of Item G.6.1 For description of the AMP, see Chapter XI.M10, "Fire Water System."	*Same as for Water Based Fire Protection System of Item G.6.1 For description of the AMP, see Chapter XI.M10, "Fire Water System."*	No
Same as for Water Based Fire Protection System of Item G.6.1 For description of the AMP, see Chapter XI.M10, "Fire Water System."	*Same as for Water Based Fire Protection System of Item G.6.1 For description of the AMP, see Chapter XI.M10, "Fire Water System."*	No
Same as for Water Based Fire Protection System of Item G.6.1 For description of the AMP, see Chapter XI.M10, "Fire Water System."	*Same as for Water Based Fire Protection System of Item G.6.1 For description of the AMP, see Chapter XI.M10, "Fire Water System."*	No
For plants built prior to 1979, as part of the plant fire protection program mandated by 10 CFR Part 50, Appendix R and Branch Technical Position (BTP) 9.5-1, visual inspection and volumetric examination should be conducted for the lower portion of the tank with potential exposure to oil and water. Engineering analysis should be carried out to determine the proper corrective actions if the measured wall thickness is below the acceptance criteria. For plants constructed after 1979, the AMP would follow the guidance of NUREG 0800 Section 9.5.1.	***(1) Scope of Program***: The program should utilize visual and volumetric examinations to manage loss of material due to corrosion on the system's intended function. ***(2) Preventive Actions:*** Verification of the structural integrity by timely inspection and corrective actions prevent corrosion. ***(3) Parameters Monitored/Inspected:*** The AMP should monitor the wall thickness of the lower portion of the component where contaminant water is possible. ***(4) Detection of Aging Effects:*** Aging degradation of the component can not occur without wall thinning; timely inspection assures detection before the loss of the intended function of the component. An acceptable method may be a one-time inspection of the lower portion of the tank. ***(5) Monitoring and Trending:*** Visual and volumetric inspection should be used to ensure that the effects of corrosion have not occurred and	Yes, detection of aging effects should be further evaluated

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.7.2	Reactor Coolant Pump Oil Collection System	Piping, Tubing, Valve Bodies	Piping and Valve Bodies: CS; Tubing: Copper, Brass	Lubricating Oil	Loss of Material	General, Galvanic, Pitting, and Crevice Corrosion	*Same as for General, Galvanic, Pitting, and Crevice Corrosion of Item G.7.1* .
G.8.1	Diesel Fire System	Diesel-Driven Fire Pump (Pump Casing) and Fuel Oil Supply Line	CS	Fuel Oil	Loss of Material	General, Galvanic, Pitting, and Crevice Corrosion	10 CFR Part 50, Appendix R. NRC BTP 9.5-1 NUREG 0800, Section 9.5.1.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) intended functions of the component are maintained. ***(6) Acceptance Criteria:*** The measured wall thickness should exceed the required minimum wall thickness determined by engineering analysis. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented according to 10 CFR 50 Appendix B requirements and will continue to be adequate for license renewal. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions, confirmation process, and administrative controls. ***(10) Opera-ting Experience*:** No significant corrosion-related problem has been reported for this component. NRC IN 94-58, "Reactor Coolant Pump Lube Oil Fire" reported that a crack in a 1 inch diameter PVC coupling in the pump oil lube system caused oil leak and subsequent fire.	
Same as for General, Galvanic, Pitting, and Crevice Corrosion of Item G.7.1 reactor coolant pump oil collect tank.	*Same as for General, Galvanic, Pitting, and Crevice Corrosion of Item G.7.1 reactor coolant pump oil collect tank,*	Yes, detection of aging effects should be further evaluated
For plants built prior to 1979, as part of the plant fire protection program mandated by 10 CFR Part 50, Appendix R and Branch Technical Position (BTP) 9.5-1, the diesel-driven fire pump is periodically tested to ensure that the fire pump can perform the intended function. Corrective actions are initiated as necessary. For plants constructed after 1979, the AMP would follow the guidance of NUREG 0800 Section 9.5.1.	***(1) Scope of Program****:* The program focuses on managing the effects of general corrosion on the intended function of the diesel fire pump. ***(2) Preventive Actions:*** Periodic testing, such as flow and discharge test, sequential starting capability test, and controller function test are performed on diesel fire pump to ensure system performance. ***(3) Parameters Monitored/Inspected:*** The diesel fire pump is under observation during the performance tests for detecting any degradation of the fuel supply line. ***(4) Detection of Aging Effects:*** The periodic performance tests should detect degradation in the fuel oil supply lines before loss of function. ***(5) Monitoring and Trending:*** The performance of fire pump is monitored during the periodic tests to detect any degradation in the system. Periodic tests provide data for trending. ***(6) Acceptance Criteria:*** No corrosion is allowed in the fuel supply line. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. As discussed in the appendix to this report, the staff finds 10 CFR Part 50, Appendix B, acceptable in addressing corrective actions, confirmation process, and administrative controls. ***(10) Operating Experience:*** No corrosion-related problem has been reported for the component.	No

H1. Diesel Fuel Oil System

H1.1 Piping

H1.1.1 Aboveground Pipe and Fittings

H1.1.2 Underground Pipe and Fittings

H1.2 Valves

H1.2.1 Body and Bonnet

H1.2.2 Closure Bolting

H1.3 Pump

H1.3.1 Casing

H1.3.2 Closure Bolting

H1.4 Tank

H1.4.1 Internal Surface

H1.4.2 External Surface

H1. Diesel Fuel Oil System

System, Structures, and Components

The system, structures, and components included in this table comprise the diesel fuel oil system and consist of aboveground and underground piping, valves, pump, and tank. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the diesel fuel oil system are classified as Group C Quality Standards.

System Interfaces

The systems that interface with the diesel fuel oil system are fire protection (Table VII G) and emergency diesel generator system (Table VII H2).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H1.1.1	Piping	Aboveground Piping and Fittings	Carbon Steel (CS)	Outdoor Ambient Conditions	Loss of Material	General, Pitting, and Crevice Corrosion	Reg. Guide 1.54. ASTM D 5163-91.
H1.1.2	Piping	Underground Piping and Fittings	CS	Soil and Ground-water	Loss of Material	General, Galvanic, Pitting, Crevice, and Micro-biologically-Influenced Corrosion (MIC)	NACE RP0169-96.
H1.2.1, H1.2.2	Valves	Body & Bonnet, Closure Bolting	CS or Low Alloy Steel (LAS)	Outdoor Ambient Conditions	Loss of Material	General, Pitting, and Crevice Corrosion	*Same as for the effect of general, pitting, and crevice corrosion on aboveground piping and fittings (Item H1.1.1).*
H1.3.1, H1.3.2	Pump	Casing, Closure Bolting	CS or LAS	Outdoor Ambient Conditions	Loss of Material	General, Pitting, and Crevice Corrosion	*Same as for the effect of general, pitting, and crevice corrosion on aboveground piping and fittings (Item H1.1.1).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
For description of the AMP, see Chapter XI.S8 "Coating Program."	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.S8 "Coating Program."	No
The AMP relies on preventive measures to mitigate corrosion by protecting the external surface of the buried piping and components, per standard industry practice based on NACE RP0169-96, with external coating, wrapping, and a cathodic protection system, and surveillance.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M8, "Outer Surface of Buried Piping and Components."	No
Same as for the effect of general, pitting, and crevice corrosion on aboveground piping and fittings (Item H1.1.1).	*Same as for the effect of general, pitting, and crevice corrosion on aboveground piping and fittings (Item H1.1.1).*	No
Same as for the effect of general, pitting, and crevice corrosion on aboveground piping and fittings (Item H1.1.1).	*Same as for the effect of general, pitting, and crevice corrosion on aboveground piping and fittings (Item H1.1.1).*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H1.4.1	Tank	Internal Surface	Carbon Steel (CS)	Fuel Oil, Water (as Contami-nant)	Loss of Material	General, Pitting, and Crevice Corrosion, Micro-biologically Influenced Corrosion	ASTM D 975-98b. ASTM D 270. ASTM D 1796-97. ASTM D 2709-96.
H1.4.1	Tank	Internal Surface	CS	Fuel Oil, Water (as Contami-nant)	Buildup of Deposit	Biofouling	*Same as for the effect of general, pitting, and crevice corrosion on tank internal surface (Item H1.4.1).*
H1.4.2	Tank	External Surface	CS	Outdoor Ambient Conditions	Loss of Material	General, Pitting, and Crevice Corrosion	NRC IN 86-99. NRC IN 86-99, S1. NRC IN 89-79. NRC IN 89-79, S1. NRC GL 98-04.

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on a combination of surveillance and maintenance procedures. The fuel oil quality is maintained by monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D975, D270, D1796, and D2709. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic cleaning/draining tanks and by verifying the quality of new oil before its introduction into the storage tanks. However, corrosion may occur at locations where contaminants may accumulate, such as tank bottom, and verification of the effectiveness of the program should ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. An acceptable verification program consists of a one–time thickness measurement of the tank bottom surface.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M9, "Fuel Oil Chemistry."	Yes, detection of aging effects should be further evaluated
Same as for the effect of general, pitting, and crevice corrosion on tank internal surface (Item H1.4.1).	*Same as for the effect of general, pitting, and crevice corrosion on tank internal surface (Item H1.4.1).*	Yes, detection of aging effects should be further evaluated
The program includes preventive measures to mitigate corrosion by protecting the external surface of carbon steel tanks, per standard industry practice, with paint or coating, and periodic system walkdown to monitor degradation of the protective paint or coating. However, for components that are supported on earthen or concrete foundations, corrosion may occur at inaccessible locations, and verification of the effectiveness of the program should ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. An acceptable verification program consists of a one–time thickness measurement of the bottom surface of the component.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M7, "Outer Surface of Above Ground Carbon Steel Tanks."	No

H2. Emergency Diesel Generator System

H2.1 Diesel Engine Cooling Water Subsystem

H2.1.1 Pipe and Fittings

H2.1.2 Jacket

H2.2 Diesel Generator Air Starting Subsystem

H2.2.1 Pipe and Fittings

H2.2.2 Valves (Hand and Check Valves)

H2.2.3 Drain Trap

H2.2.4 Air Accumulator Vessel

H2.3 Diesel Generator Combustion Air Intake Subsystem

H2.3.1 Piping and Fittings

H2.3.2 Filter

H2.3.3 Muffler

H2.4 Diesel Generator Combustion Exhaust Air Subsystem

H2.4.1 Piping and Fittings

H2.4.2 Muffler

H2.5 Diesel Generator Fuel Oil Subsystem

H2.5.1 Tanks (Day and Dip Tanks)

H2.5.2 Strainer

H2. Emergency Diesel Generator System

System, Structures, and Components

The system, structures, and components included in this table comprise the emergency diesel generator system and contain piping, valves, filter, muffler, strainer, and tanks. These are features of the cooling water, starting air, combustion air intake, combustion exhaust air, and diesel fuel oil subsystems. Based on the Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the emergency diesel generator system are classified as Group C Quality Standards.

System Interfaces

The systems that interface with the emergency diesel generator system include the diesel fuel oil system (Table VII H1), closed cycle cooling water system (Table VII C2) and, for some plants, open cycle cooling water system (Table VII C1).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H2.1.1, H2.1.2	Diesel Engine Cooling Water Subsystem (Serviced by Closed Cycle Cooling Water System)	Piping and Fittings, Jacket	Carbon Steel (CS)	Chemically Treated Demi-neralized Water <90°C (194°F)	Loss of Material	General, Pitting and Crevice Corrosion, Microbio-logically Induced Corrosion	ASME OM S/G, Part 2. NRC GL 89-13. NRC GL 89-13, Suppl. 1. EPRI TR-107396.
H2.1.1, H2.1.2	Diesel Engine Cooling Water Subsystem (Serviced by Open Cycle Cooling Water System)	Piping and Fittings, Jacket	Carbon Steel (CS)	Raw, Untreated Salt Water or Fresh Water	Loss of Material	Microbio-logically Influenced Corrosion	NRC GL 89-13. NRC GL 89-13, Suppl. 1. NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96.
H2.1.1, H2.1.2	Diesel Engine Cooling Water Subsystem (Serviced by Open Cycle Cooling Water System)	Piping and Fittings, Jacket	Carbon Steel (CS)	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	*Same as for the effect of Microbio-logically Influenced Corrosion on piping and fittings, jacket (H2.1.1, H2.1.2).*
H2.1.1, H2.1.2	Diesel Engine Cooling Water Subsystem	Piping and Fittings, Jacket	CS	Chemically Treated (With Hydrazine) Demi-neralized Water <90°C (194°F)	Wall Thinning	Erosion/ Corrosion	-
H2.1.1, H2.1.2	Diesel Engine Cooling Water Subsystem	Piping and Fittings, Jacket	CS	Chemically Treated (With Hydrazine) Demi-neralized Water <90°C (194°F)	Cyclic Load Induced Cracking	Vibration-Induced Cracking	-

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The program relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors based on the guidelines of EPRI TR–107396 for closed–cycle cooling water (CCCW) systems, and performance and functional testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the CCCW system or components serviced by the CCCW system are performing their functions acceptably.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M4 "Closed Cycle Cooling Water System."	No
The program relies on implementation of the recommendations of Generic Letter 89-13 to ensure that open-cycle cooling water (OCCW) (or service water) system can be managed for an extended period of operation. The program includes surveillance and control techniques to manage flow blockage problems caused by biofouling, corrosion, erosion, protective coating failures, and silting, in the OCCW systems or structures and components serviced by the OCCW systems.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M3 "Open Cycle Cooling Water System."	No
Same as for the effect of Microbio-logically Influenced Corrosion on piping and fittings, jacket (H2.1.1, H2.1.2).	*Same as for the effect of Microbio-logically Influenced Corrosion on piping and fittings, jacket (H2.1.1, H2.1.2).*	No
Due to the low flow velocity and low operating temperature of the diesel engine cooling water subsystem, the effects of erosion/corrosion are generally not monitored/inspected. However, the system is chemically treated with hydrazine to lower the dissolved oxygen level in order to minimize the corrosion effects. Lowering the oxygen content increases the susceptibility of the carbon steel piping to erosion/ corrosion. This susceptibility depends on the flow rate which is plant-specific. Therefore a plant-specific AMP is necessary.	Plant-specific aging management program is to be evaluated.	Yes, plant specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant specific

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H2.2.1 through H2.2.4	Diesel Engine Starting Air Subsystem	Piping and Fittings, Hand and Check Valves, Drain Trap, Air Accumulator Vessel	CS	Moist Air	Loss of Material	General, Pitting, and Crevice Corrosion	-
H2.3.1 H2.3.2 H2.3.3	Diesel Engine Combustion Air Intake Subsystem	Piping and Fittings, Filter, Muffler	CS	Moist Air	Loss of Material	General, Pitting, and Crevice Corrosion	-
H2.4.1 H2.4.2	Diesel Engine Combustion Air Exhaust Subsystem	Piping and Fittings, Muffler	CS	Hot Diesel Engine Exhaust Gases containing Moisture and Particulates	Loss of Material	General, Pitting, and Crevice Corrosion	-
H2.5.1	Diesel Engine Fuel Oil Subsystem	Tanks (Day and Dip)	Carbon Steel	Diesel Fuel Oil	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	ASTM D 975-98b. ASTM D 270. ASTM D 1796-97. ASTM D 2709-96.
H2.5.2	Diesel Engine Fuel Oil Subsystem	Strainer	Cast iron	Diesel Fuel Oil	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	*Same as for the effects of general corrosion on the day and dip tanks (Item H2.5.1).*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant specific
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, plant specific
The program includes a combination of surveillance and maintenance procedures. The fuel oil quality is maintained by monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D975, D270, D1796, and D2709. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic cleaning/draining tanks and by verifying the quality of new oil before its introduction into the storage tanks. However, corrosion may occur at locations where contaminants may accumulate, such as tank bottom, and verification of the effectiveness of the program should ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. An acceptable verification program consists of a one–time thickness measurement of the tank bottom surface.	For the evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M9, "Fuel Oil Chemistry."	Yes, detection of aging effects should be further evaluated
Same as for the effects of general corrosion on the day and dip tanks (Item H2.5.1).	*Same as for the effects of general corrosion on the day and dip tanks (Item H2.5.1).*	Yes, detection of aging effects should be further evaluated

I. Carbon Steel Components

I.1 Carbon Steel Components

I.1.1 External Surfaces

I.2 Closure Bolting

I.2.1 In High-Pressure or High-Temperature Systems

I. Carbon Steel Components

System, Structures, and Components

This table includes the aging management programs for the external surfaces of all carbon steel structures and components including closure boltings in the Auxiliary System in the pressurized water reactors (PWRs) and boiling water reactors (BWRs).

System Interfaces

The structures and components covered in this table belong to the Auxiliary Systems in PWRs and BWRs.

VII AUXILIARY SYSTEMS
I. CARBON STEEL COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
I.1.1	Carbon Steel Components (PWRs)	External Surfaces	Carbon Steel (CS), Low-Alloy Steel (LAS)	Air, Leaking Chemically Treated Borated Water up to 340°C (644°F)	Loss of Material	Boric Acid Corrosion of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 or later Edition as approved in 10 CFR 50 55a. NRC IN 86-108 S 3.
I.1.1	Carbon Steel Components (PWRs and BWRs)	External Surfaces	CS, LAS	Air, Moisture, and Humidity	Loss of Material	Atmo-spheric Corrosion	Reg. Guide 1.54. ASTM D5163-91.
I.2.1	Closure Bolting	In High-Pressure or High-Temperature Systems	CS, LAS	Air, Moisture, Humidity, and Leaking Fluid	Loss of Material	Atmo-spheric Corrosion	NUREG-1339. EPRI NP-5769. EPRI NP-5067. ASME Section XI, 1989 or later edition as approved in 10 CFR 50.55a. NRC GL 91-17. IEB 82-02.
I.2.1	Closure Bolting	In High-Pressure or High-Temperature Systems	CS, LAS	Air, Moisture, Humidity, and Leaking Fluid	Loss of Preload	Stress Relaxation	*Same as for the effect of atmospheric corrosion on Item H.2.1 closure bolting in high-pressure high-temperature systems.*
I.2.1	Closure Bolting	In High-Pressure or High-Temperature Systems	CS, LAS	Air, Moisture, Humidity, and Leaking Fluid	Crack Initiation and Growth	Cyclic Loading, Stress Corrosion Cracking	*Same as for the effect of atmospheric corrosion on Item H.2.1 closure bolting in high-pressure high-temperature systems.*

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Implementation of NRC Generic Letter 88-05 and inservice inspection (ISI) in conformance with ASME Section XI (1989 edition or later edition as approved in 10 CFR 50.55a), Subsection IWB, Table IWB 2500-1, to monitor the condition of the reactor coolant pressure boundary for occurrences of borated water leakage. Periodic visual inspection of adjacent structures, components and supports for evidence of leakage and corrosion should be an element of the applicant's GL 88-05 monitoring program.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M5, "Boric Acid Corrosion."	No
For description of the AMP, see Chapter XI.S8 "Coating Program."	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.S8 "Coating Program."	No
The program relies on recommendations for a comprehensive bolting integrity program delineated in NUREG–1339 and industry's recommendations delineated in EPRI NP-5769, with the exceptions noted in NUREG 1339, for safety related bolting, and EPRI NP-5067 for other bolting.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M12 "Bolting Integrity."	No
Same as for the effect of atmospheric corrosion on Item H.2.1 closure bolting in high-pressure high-temperature systems.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M12 "Bolting Integrity."	No
Same as for the effect of atmospheric corrosion on Item H.2.1 closure bolting in high-pressure high-temperature systems.	For evaluation and technical basis of the 10 elements of the AMP, see Chapter XI.M12 "Bolting Integrity."	No

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