NYS00146B
Submitted: December 15, 2011

III STRUCTURES AND COMPONENT SUPPORTS
B1.1 Class 1

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B1.1-8 (TP-3)	III.B1.1.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
III.B1.1-9 (TP-5)	III.B1.1.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air – indoor uncontrolled	None	None	No
III.B1.1-10 (TP-4)	III.B1.1.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air with borated water leakage	None	None	No

III B1.1	STRUCTURES AND COMPONENT SUPPORTS Class 1						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B1.1-11 (TP-10)	III.B1.1.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel; steel	Treated Water < 60C (<140 F)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water, and Chapter XI.S3, "ASME Section XI, Subsection IWF"	No
III.B1.1-12 (T-26)	III.B1.1.1-c	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled	Cumulative fatigue damage/ fatigue (Only if CLB fatigue analysis exists)	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
III.B1.1-13 (T-24)	III.B1.1.1-a	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ general and pitting corrosion	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No

III STRUCTURES AND COMPONENT SUPPORTS
B1.1 Class 1

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B1.1-14 (T-25)	III.B1.1.1-b	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No
III.B1.1-15 (T-33)	III.B1.1.3-a	Vibration isolation elements	Non-metallic (e.g., Rubber)	Air – indoor uncontrolled or air – outdoor	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No

III STRUCTURES AND COMPONENT SUPPORTS
B1.2 Class 2 and 3

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B1.2-1 (T-29)	III.B1.2.3-a	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reinforced concrete; Grout	Air – indoor uncontrolled or air – outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, “Structures Monitoring Program”	Yes, if not within the scope of the applicant’s structures monitoring program
III.B1.2-2 (T-28)	III.B1.2.2-a	Constant and variable load spring hangers; guides; stops	Steel	Air – indoor uncontrolled or air – outdoor	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No
III.B1.2-3 (T-32)	III.B1.2.2-a	Sliding surfaces	Lubrite®	Air – indoor uncontrolled or air – outdoor	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No

III STRUCTURES AND COMPONENT SUPPORTS
B1.2 Class 2 and 3

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B1.2-4 (TP-8)	III.B1.2.	Support members; welds; bolted connections; support anchorage to building structure	Aluminum	Air – indoor uncontrolled	None	None	No
III.B1.2-5 (TP-11)	III.B1.2.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel	Air – indoor uncontrolled	None	None	No
III.B1.2-6 (TP-3)	III.B1.2.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No

III	STRUCTURES AND COMPONENT SUPPORTS						
B1.2	Class 2 and 3						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B1.2-7 (TP-5)	III.B1.2.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air – indoor uncontrolled	None	None	No
III.B1.2-8 (TP-4)	III.B1.2.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air with borated water leakage	None	None	No
III.B1.2-9 (T-26)	III.B1.2.1-c	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled	Cumulative fatigue damage/ fatigue (Only if CLB fatigue analysis exists)	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

III STRUCTURES AND COMPONENT SUPPORTS
B1.2 Class 2 and 3

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B1.2-10 (T-24)	III.B1.2.1-a	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ general and pitting corrosion	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No
III.B1.2-11 (T-25)	III.B1.2.1-b	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No
III.B1.2-12 (T-33)	III.B1.2.2-a	Vibration isolation elements	Non-metallic (e.g., Rubber)	Air – indoor uncontrolled or air – outdoor	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No

III B1.3	STRUCTURES AND COMPONENT SUPPORTS Class MC (BWR Containment Supports)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B1.3-1 (T-29)	III.B1.3.3-a	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reinforced concrete; Grout	Air – indoor uncontrolled or air – outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, "Structures Monitoring Program"	Yes, if not within the scope of the applicant's structures monitoring program
III.B1.3-2 (T-28)	III.B1.3.2-a	Constant and variable load spring hangers; guides; stops	Steel	Air – indoor uncontrolled or air – outdoor	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No
III.B1.3-3 (T-32)	III.B1.3.2-a	Sliding surfaces	Lubrite®	Air – indoor uncontrolled or air – outdoor	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No

III STRUCTURES AND COMPONENT SUPPORTS
B1.3 Class MC (BWR Containment Supports)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B1.3-4 (TP-8)	III.B1.3.	Support members; welds; bolted connections; support anchorage to building structure	Aluminum	Air – indoor uncontrolled	None	None	No
III.B1.3-5 (TP-11)	III.B1.3.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel	Air – indoor uncontrolled	None	None	No
III.B1.3-6 (TP-3)	III.B1.3.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No

III STRUCTURES AND COMPONENT SUPPORTS
B1.3 Class MC (BWR Containment Supports)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B1.3-7 (TP-5)	III.B1.3.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air – indoor uncontrolled	None	None	No
III.B1.3-8 (TP-4)	III.B1.3.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air with borated water leakage	None	None	No
III.B1.3-9 (T-26)	III.B1.3.1-b	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled	Cumulative fatigue damage/ fatigue (Only if CLB fatigue analysis exists)	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

III B1.3	STRUCTURES AND COMPONENT SUPPORTS Class MC (BWR Containment Supports)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B1.3-10 (T-24)	III.B1.3.1-a	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ general and pitting corrosion	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No
III.B1.3-11 (T-33)	III.B1.3.2-a	Vibration isolation elements	Non-metallic (e.g., Rubber)	Air – indoor uncontrolled or air – outdoor	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No

B2. SUPPORTS FOR CABLE TRAYS, CONDUIT, HVAC DUCTS, TUBETRACK®, INSTRUMENT TUBING, NON-ASME PIPING AND COMPONENTS

Systems, Structures, and Components

This section addresses supports and anchorage for cable trays, conduit, heating, ventilation, and air-conditioning (HVAC) ducts, TubeTrack®, instrument tubing, and non-ASME piping and components. Applicable aging effects are identified and the aging management review is presented for each applicable combination of support component and aging effect.

System Interfaces

Physical interfaces exist with the structure, system, or component being supported and with the building structural element to which the support is anchored. A primary function of supports is to provide anchorage of the supported element for internal and external design basis events, so that the supported element can perform its intended function.

III STRUCTURES AND COMPONENT SUPPORTS
B2 Supports for Cable Trays, Conduit, HVAC Ducts, TubeTrack, Instrument Tubing, Non-ASME Piping and Components

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B2-1 (T-29)	III.B2.2-a	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reinforced concrete; Grout	Air – indoor uncontrolled or air – outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, "Structures Monitoring Program"	Yes, if not within the scope of the applicant's structures monitoring program
III.B2-2 (TP-1)	III.B2.	Sliding support bearings and sliding support surfaces	Lubrite®, graphitic tool steel	Air – indoor uncontrolled	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S6, "Structures Monitoring Program"	No
III.B2-3 (TP-2)	III.B2.	Sliding support bearings and sliding support surfaces	Lubrite®, graphitic tool steel	Air – outdoor	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S6, "Structures Monitoring Program"	No

III STRUCTURES AND COMPONENT SUPPORTS
B2 Supports for Cable Trays, Conduit, HVAC Ducts, TubeTrack, Instrument Tubing, Non-ASME Piping and Components

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B2-4 (TP-8)	III.B2.	Support members; welds; bolted connections; support anchorage to building structure	Aluminum	Air – indoor uncontrolled	None	None	No
III.B2-5 (TP-11)	III.B2.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel	Air – indoor uncontrolled	None	None	No
III.B2-6 (TP-3)	III.B2.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No

III STRUCTURES AND COMPONENT SUPPORTS
B2 Supports for Cable Trays, Conduit, HVAC Ducts, TubeTrack, Instrument Tubing, Non-ASME Piping and Components

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B2-7 (TP-6)	III.B2.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum, stainless steel	Air – outdoor	Loss of material/ pitting and crevice corrosion	Chapter XI.S6, "Structures Monitoring Program"	No
III.B2-8 (TP-5)	III.B2.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air – indoor uncontrolled	None	None	No
III.B2-9 (TP-4)	III.B2.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air with borated water leakage	None	None	No

III	STRUCTURES AND COMPONENT SUPPORTS						
B2	Supports for Cable Trays, Conduit, HVAC Ducts, TubeTrack, Instrument Tubing, Non-ASME Piping and Components						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B2-10 (T-30)	III.B2.1-a	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ general and pitting corrosion	Chapter XI.S6, "Structures Monitoring Program"	Yes, if not within the scope of the applicant's structures monitoring program
III.B2-11 (T-25)	III.B2.1-b	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

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B3. ANCHORAGE OF RACKS, PANELS, CABINETS, AND ENCLOSURES FOR ELECTRICAL EQUIPMENT AND INSTRUMENTATION

Systems, Structures, and Components

This section addresses supports and anchorage for racks, panels, cabinets, and enclosures for electrical equipment and instrumentation. Applicable aging effects are identified and the aging management review is presented for each applicable combination of support component and aging effect.

System Interfaces

Physical interfaces exist with the structure, system, or component being supported and with the building structural element to which the support is anchored. A primary function of supports is to provide anchorage of the supported element for internal and external design basis events, so that the supported element can perform its intended function.

III STRUCTURES AND COMPONENT SUPPORTS
B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B3-1 (T-29)	III.B3.2-a	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reinforced concrete; Grout	Air – indoor uncontrolled or air – outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, “Structures Monitoring Program”	Yes, if not within the scope of the applicant’s structures monitoring program
III.B3-2 (TP-8)	III.B3.	Support members; welds; bolted connections; support anchorage to building structure	Aluminum	Air – indoor uncontrolled	None	None	No
III.B3-3 (TP-11)	III.B3.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel	Air – indoor uncontrolled	None	None	No

III STRUCTURES AND COMPONENT SUPPORTS
B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B3-4 (TP-3)	III.B3.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
III.B3-5 (TP-5)	III.B3.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air – indoor uncontrolled	None	None	No
III.B3-6 (TP-4)	III.B3.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air with borated water leakage	None	None	No

III STRUCTURES AND COMPONENT SUPPORTS B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B3-7 (T-30)	III.B3.1-a	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ general and pitting corrosion	Chapter XI.S6, “Structures Monitoring Program”	Yes, if not within the scope of the applicant’s structures monitoring program
III.B3-8 (T-25)	III.B3.1-b	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No

B4. SUPPORTS FOR EMERGENCY DIESEL GENERATOR (EDG), HVAC SYSTEM COMPONENTS, AND OTHER MISCELLANEOUS MECHANICAL EQUIPMENT

Systems, Structures, and Components

This section addresses supports and anchorage for the emergency diesel generator (EDG) and HVAC system components, and other miscellaneous mechanical equipment. Applicable aging effects are identified and the aging management review is presented for each applicable combination of support component and aging effect.

System Interfaces

Physical interfaces exist with the structure, system, or component being supported and with the building structural element to which the support is anchored. A primary function of supports is to provide anchorage of the supported element for internal and external design basis events, so that the supported element can perform its intended function.

III STRUCTURES AND COMPONENT SUPPORTS
B4 Supports for Emergency Diesel Generator (EDG), HVAC System Components, and Other Miscellaneous Mechanical Equipment

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B4-1 (T-29)	III.B4.3-a	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reinforced concrete; Grout	Air – indoor uncontrolled or air – outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, “Structures Monitoring Program”	Yes, if not within the scope of the applicant’s structures monitoring program
III.B4-2 (TP-1)	III.B4.	Sliding support bearings and sliding support surfaces	Lubrite®, graphitic tool steel	Air – indoor uncontrolled	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S6, “Structures Monitoring Program”	No
III.B4-3 (TP-2)	III.B4.	Sliding support bearings and sliding support surfaces	Lubrite®, graphitic tool steel	Air – outdoor	Loss of mechanical function/ corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S6, “Structures Monitoring Program”	No

III STRUCTURES AND COMPONENT SUPPORTS B4 Supports for Emergency Diesel Generator (EDG), HVAC System Components, and Other Miscellaneous Mechanical Equipment							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B4-4 (TP-8)	III.B4.	Support members; welds; bolted connections; support anchorage to building structure	Aluminum	Air – indoor uncontrolled	None	None	No
III.B4-5 (TP-11)	III.B4.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel	Air – indoor uncontrolled	None	None	No
III.B4-6 (TP-3)	III.B4.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

III B4	STRUCTURES AND COMPONENT SUPPORTS Supports for Emergency Diesel Generator (EDG), HVAC System Components, and Other Miscellaneous Mechanical Equipment						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B4-7 (TP-6)	III.B4.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum, stainless steel	Air – outdoor	Loss of material/ pitting and crevice corrosion	Chapter XI.S6, "Structures Monitoring Program"	No
III.B4-8 (TP-5)	III.B4.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air – indoor uncontrolled	None	None	No
III.B4-9 (TP-4)	III.B4.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air with borated water leakage	None	None	No

III STRUCTURES AND COMPONENT SUPPORTS B4 Supports for Emergency Diesel Generator (EDG), HVAC System Components, and Other Miscellaneous Mechanical Equipment							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B4-10 (T-30)	III.B4.1-a	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ general and pitting corrosion	Chapter XI.S6, "Structures Monitoring Program"	Yes, if not within the scope of the applicant's structures monitoring program
III.B4-11 (T-25)	III.B4.1-b	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
III.B4-12 (T-31)	III.B4.2-a	Vibration isolation elements	Non-metallic (e.g., Rubber)	Air – indoor uncontrolled or air – outdoor	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	Chapter XI.S6, "Structures Monitoring Program"	Yes, if not within the scope of the applicant's structures monitoring program

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B5. SUPPORTS FOR PLATFORMS, PIPE WHIP RESTRAINTS, JET IMPINGEMENT SHIELDS, MASONRY WALLS, AND OTHER MISCELLANEOUS STRUCTURES

Systems, Structures, and Components

This section addresses supports and anchorage for platforms, pipe whip restraints, jet impingement shields, masonry walls, and other miscellaneous structures. Applicable aging effects are identified and the aging management review is presented for each applicable combination of support component and aging effect.

System Interfaces

Physical interfaces exist with the structure, system, or component being supported and with the building structural element to which the support is anchored. A primary function of supports is to provide anchorage of the supported element for internal and external design basis events, so that the supported element can perform its intended function.

III STRUCTURES AND COMPONENT SUPPORTS
B5 Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, Masonry Walls, and Other Miscellaneous Structures

Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B5-1 (T-29)	III.B5.2-a	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reinforced concrete; Grout	Air – indoor uncontrolled or air – outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, "Structures Monitoring Program"	Yes, if not within the scope of the applicant's structures monitoring program
III.B5-2 (TP-8)	III.B5.	Support members; welds; bolted connections; support anchorage to building structure	Aluminum	Air – indoor uncontrolled	None	None	No
III.B5-3 (TP-11)	III.B5.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel	Air – indoor uncontrolled	None	None	No

III	STRUCTURES AND COMPONENT SUPPORTS						
B5	Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, Masonry Walls, and Other Miscellaneous Structures						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
III.B5-4 (TP-3)	III.B5.	Support members; welds; bolted connections; support anchorage to building structure	Galvanized steel, aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No
III.B5-5 (TP-5)	III.B5.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air – indoor uncontrolled	None	None	No
III.B5-6 (TP-4)	III.B5.	Support members; welds; bolted connections; support anchorage to building structure	Stainless steel	Air with borated water leakage	None	None	No

III STRUCTURES AND COMPONENT SUPPORTS
B5 Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, Masonry Walls, and Other Miscellaneous Structures

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
III.B5-7 (T-30)	III.B5.1-a	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air – indoor uncontrolled or air – outdoor	Loss of material/ general and pitting corrosion	Chapter XI.S6, “Structures Monitoring Program”	Yes, if not within the scope of the applicant’s structures monitoring program
III.B5-8 (T-25)	III.B5.1-b	Support members; welds; bolted connections; support anchorage to building structure	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No

CHAPTER IV

REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

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MAJOR PLANT SECTIONS

A1. Reactor Vessel (Boiling Water Reactor)

A2. Reactor Vessel (Pressurized Water Reactor)

B1. Reactor Vessel Internals (Boiling Water Reactor)

B2. Reactor Vessel Internals (PWR) - Westinghouse

B3. Reactor Vessel Internals (PWR) - Combustion Engineering

B4. Reactor Vessel Internals (PWR) - Babcock and Wilcox

C1. Reactor Coolant Pressure Boundary (Boiling Water Reactor)

C2. Reactor Coolant System and Connected Lines (Pressurized Water Reactor)

D1. Steam Generator (Recirculating)

D2. Steam Generator (Once-Through)

E. Common Miscellaneous Material/Environment Combinations

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A1. REACTOR VESSEL (BOILING WATER REACTOR)

Systems, Structures, and Components

This section addresses the boiling water reactor (BWR) pressure vessel and consists of the vessel shell and flanges, attachment welds, top and bottom heads, nozzles (including safe ends) for the reactor coolant recirculating system and connected systems (such as high and low pressure core spray, high and low pressure coolant injection, main steam, and feedwater systems), penetrations for control rod drive (CRD) stub tubes, instrumentation, standby liquid control, flux monitor, drain lines, and control rod drive mechanism housings. The support skirt and attachment welds for vessel supports are also included in the following table for the BWR vessel. Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” all structures and components that comprise the reactor vessel are governed by Group A Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the reactor vessel include the reactor vessel internals (IV.B1), the reactor coolant pressure boundary (IV.C1), the emergency core cooling system (V.D2), and standby liquid control system (VII.E2).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A1 Reactor Vessel (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A1-1 (R-68)	IV.A1.4-a	Nozzle safe ends (and associated welds) High pressure core spray Low pressure core spray Control rod drive return line Recirculating water Low pressure coolant injection or RHR injection mode	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	Chapter XI.M7, “BWR Stress Corrosion Cracking,” and Chapter XI.M2, “Water Chemistry,” for BWR water	No
IV.A1-2 (R-66)	IV.A1.3-c	Nozzles Control rod drive return line	Steel (with or without stainless steel cladding)	Reactor coolant	Cracking/ cyclic loading	Chapter XI.M6, “BWR Control Rod Drive Return Line Nozzle”	No
IV.A1-3 (R-65)	IV.A1.3-b	Nozzles Feedwater	Steel (with or without stainless steel cladding)	Reactor coolant	Cracking/ cyclic loading	Chapter XI.M5, “BWR Feedwater Nozzle”	No

IV A1	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Vessel (BWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.A1-4 (R-67)	IV.A1.3-e	Nozzles Low pressure coolant injection or RHR injection mode	Steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement	Neutron irradiation embrittlement is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 1E17 n/cm^2 (E >1 MeV) at the end of the license renewal term. In accordance with approved BWRVIP-74, the TLAA is to evaluate the impact of neutron embrittlement on: (a) the adjusted reference temperature values used for calculation of the plant's pressure-temperature limits, (b) the need for inservice inspection of circumferential welds, and (c) the Charpy upper shelf energy or the equivalent margins analyses performed in accordance with 10 CFR Part 50, Appendix G The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations. See the Standard Review Plan, Section 4.2 "Reactor Vessel Neutron Embrittlement" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A1 Reactor Vessel (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A1-5 (R-69)	IV.A1.5-a	Penetrations Control rod drive stub tubes Instrumentation Jet pump instrument Standby liquid control Flux monitor Drain line	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M8, “BWR Penetrations,” and Chapter XI.M2, “Water Chemistry,” for BWR water	No
IV.A1-6 (R-70)	IV.A1.7-a	Pressure vessel support skirt and attachment welds	Steel	Air – indoor uncontrolled	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A1 Reactor Vessel (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A1-7 (R-04)	IV.A1.3-a IV.A1.3-d IV.A1.5-b IV.A1.2-a IV.A1.2-b IV.A1.2-b IV.A1.3-d IV.A1.4-b IV.A1.1-b IV.A1.5-b IV.A1.2-a IV.A1.5-b IV.A1.5-b IV.A1.5-b IV.A1.6-a IV.A1.5-b IV.A1.2-b IV.A1.2-b	Reactor vessel components: Flanges; Nozzles; Penetrations; Safe ends; Thermal sleeves; Vessel shells, heads and welds	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.A1-8 (RP-25)	IV.A1.	Reactor Vessel: Flanges, nozzles; penetrations; safe ends; vessel shells, heads and welds	Stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor Coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A1 Reactor Vessel (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A1-9 (R-60)	IV.A1.1-c	Top head enclosure Closure studs and nuts	High-strength low alloy steel Maximum tensile strength < 1172 MPa (<170 ksi)	Air with reactor coolant leakage	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	Chapter XI.M3, “Reactor Head Closure Studs”	No
IV.A1-10 (R-61)	IV.A1.1-d	Top head enclosure Vessel flange leak detection line	Stainless steel; nickel alloy	Air with reactor coolant leakage (Internal) or Reactor Coolant	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line.	Yes, plant-specific
IV.A1-11 (R-59)	IV.A1.1-a	Top head enclosure (without cladding) Top head Nozzles (vent, top head spray or RCIC, and spare)	Steel	Reactor coolant	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
IV.A1-12 (R-64)	IV.A1.2-e	Vessel shell Attachment welds	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	Chapter XI.M4, “BWR Vessel ID Attachment Welds,” and Chapter XI.M2, “Water Chemistry,” for BWR water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A1 Reactor Vessel (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A1-13 (R-62)	IV.A1.2-c	Vessel shell Intermediate beltline shell Beltline welds	Steel (with or without stainless steel cladding)	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement	Neutron irradiation embrittlement is a time dependent aging mechanism to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 1E17 n/cm^2 (E >1 MeV) at the end of the license renewal term. Aspects of this evaluation may involve a TLAA. In accordance with approved BWRVIP-74, the TLAA is to evaluate the impact of neutron embrittlement on: (a) the adjusted reference temperature values used for calculation of the plant's pressure-temperature limits, (b) the need for inservice inspection of circumferential welds, and (c) the Charpy upper shelf energy or the equivalent margins analyses performed in accordance with 10 CFR Part 50, Appendix G. Additionally, the applicant is to monitor axial beltline weld embrittlement. One acceptable method is to determine that the mean RT_{NDT} of the axial beltline welds at the end of the extended period of operation is less than the value specified by the staff in its March 7, 2000 letter (ADAMS ML031430372). See the Standard Review Plan, Section 4.2 "Reactor Vessel Neutron Embrittlement" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A1 Reactor Vessel (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A1-14 (R-63)	IV.A1.2-d	Vessel shell Intermediate beltline shell Beltline welds	Steel (with or without stainless steel cladding)	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement	Chapter XI.M31, “Reactor Vessel Surveillance”	No

A2. REACTOR VESSEL (PRESSURIZED WATER REACTOR)

Systems, Structures, and Components

This section addresses the pressurized water reactor (PWR) vessel pressure boundary and consists of the vessel shell and flanges, the top closure head and bottom head, the control rod drive (CRD) mechanism housings, nozzles (including safe ends) for reactor coolant inlet and outlet lines and safety injection, and penetrations through either the closure head or bottom head domes for instrumentation and leakage monitoring tubes. Attachments to the vessel such as core support pads, as well as pressure vessel support and attachment welds, are also included in the table. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all systems, structures, and components that comprise the reactor coolant system are governed by Group A Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the PWR reactor vessel include the reactor vessel internals (IV.B2, IV.B3, and IV.B4, respectively, for Westinghouse, Combustion Engineering, and Babcock and Wilcox designs), the reactor coolant system and connected lines (IV.C2), and the emergency core cooling system (V.D1).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-1 (RP-13)	IV.A2.	Bottom-mounted guide tube	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
IV.A2-2 (R-71)	IV.A2.1-c	Closure head Stud assembly	High-strength low alloy steel Maximum tensile strength < 1172 MPa (<170 ksi)	Air with reactor coolant leakage	Cracking/ stress corrosion cracking	Chapter XI.M3, “Reactor Head Closure Studs”	No
IV.A2-3 (R-72)	IV.A2.1-d	Closure head Stud assembly	High-strength low alloy steel Maximum tensile strength < 1172 MPa (<170 ksi)	Air with reactor coolant leakage	Loss of material/ wear	Chapter XI.M3, “Reactor Head Closure Studs”	No
IV.A2-4 (R-73)	IV.A2.1-e	Closure head Stud assembly	Low alloy steel	Air with reactor coolant leakage	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM A2 Reactor Vessel (PWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.A2-5 (R-74)	IV.A2.1-f	Closure head Vessel flange leak detection line	Stainless steel	Air with reactor coolant leakage (Internal) or Reactor Coolant	Cracking/ stress corrosion cracking	A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line.	Yes, plant-specific
IV.A2-6 (R-78)	IV.A2.2-e	Control rod drive head penetration Flange bolting	Stainless steel	Air with reactor coolant leakage	Cracking/ stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No
IV.A2-7 (R-79)	IV.A2.2-f	Control rod drive head penetration Flange bolting	Stainless steel	Air with reactor coolant leakage	Loss of material/ wear	Chapter XI.M18, "Bolting Integrity"	No
IV.A2-8 (R-80)	IV.A2.2-g	Control rod drive head penetration Flange bolting	Stainless steel	Air with reactor coolant leakage	Loss of preload/ thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-9 (R-75)	IV.A2.2-a	Control rod drive head penetration Nozzle and welds	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water and Chapter XI.M11-A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors (PWRs Only)"	No
IV.A2-10 (R-77)	IV.A2.2-d	Control rod drive head penetration Pressure housing	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F)	Loss of fracture toughness/ thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
IV.A2-11 (R-76)	IV.A2.2-b	Control rod drive head penetration Pressure housing	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" and, For nickel alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to submit a plant-specific AMP to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-12 (R-88)	IV.A2.6-a	Core support pads/ core guide lugs	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" and, Comply with applicable NRC Orders and provide a commitment in the FSAR supplement to submit a plant-specific AMP to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed
IV.A2-13 (R-17)	IV.A2.8-b IV.A2.5-e IV.A2.1-a	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
IV.A2-14 (RP-28)	IV.A2.	Flanges; nozzles; penetrations; pressure housings; safe ends; vessel shells, heads and welds	Stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor Coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
IV.A2-15 (R-83)	IV.A2.4-b	Nozzle safe ends and welds: Inlet Outlet Safety injection	Stainless steel; nickel alloy welds and/or buttering	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water	No

IV A2	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Vessel (PWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.A2-16 (R-81)	IV.A2.3-a	Nozzles Inlet Outlet Safety injection	Steel with stainless steel cladding	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement	Neutron irradiation embrittlement is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 1E17 n/cm^2 (E >1 MeV) at the end of the license renewal term. The TLAA is to evaluate the impact of neutron embrittlement on: (a) the RT_{PTS} value based on the requirements in 10 CFR 50.61, (b) the adjusted reference temperature values used for calculation of the plant's pressure-temperature limits, and (c) the Charpy upper shelf energy or the equivalent margins analyses performed in accordance with 10 CFR Part 50, Appendix G requirements. The applicant may choose to demonstrate that the materials in the inlet, outlet, and safety injection nozzles are not controlling for the TLAA evaluations.	Yes, TLAA
IV.A2-17 (R-82)	IV.A2.3-b	Nozzles Inlet Outlet Safety injection	Steel with stainless steel cladding	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement	Chapter XI.M31, "Reactor Vessel Surveillance"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-18 (R-90)	IV.A2.7-b	Penetrations Head vent pipe (top head) Instrument tubes (top head)	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components and Chapter XI.M2, “Water Chemistry,” for PWR primary water and Chapter XI.M11-A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors (PWRs Only)"	No
IV.A2-19 (R-89)	IV.A2.7-a	Penetrations Instrument tubes (bottom head)	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry,” for PWR primary water and Comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed
IV.A2-20 (R-70)	IV.A2.8-a	Pressure vessel support skirt and attachment welds	Steel	Air – indoor uncontrolled	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-21 (R-219)	IV.A2.3-c IV.A2.5-d IV.A2.4-a IV.A2.4-a IV.A2.4-a IV.A2.3-c IV.A2.5-d IV.A2.2-c IV.A2.1-b IV.A2.5-d IV.A2.5-d IV.A2.3-c IV.A2.2-c	Reactor vessel components: Flanges; Nozzles; Penetrations; Pressure housings; Safe ends; Thermal sleeves; Vessel shells, heads and welds	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-22 (R-85)	IV.A2.5-b	Vessel shell Upper shell Intermediate and lower shell (including beltline welds)	SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process	Reactor coolant	Crack growth/ cyclic loading	Growth of intergranular separations (underclad cracks) in low-alloy steel forging heat affected zone under austenitic stainless steel cladding is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for all the SA 508-Cl 2 forgings where the cladding was deposited with a high heat input welding process. The methodology for evaluating an underclad flaw is in accordance with the current well-established flaw evaluation procedure and criterion in the ASME Section XI Code. See the Standard Review Plan, Section 4.7, “Other Plant-Specific Time-Limited Aging Analysis,” for generic guidance for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-23 (R-84)	IV.A2.5-a	Vessel shell Upper shell Intermediate and lower shell (including beltline welds)	Steel with stainless steel cladding	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement	Neutron irradiation embrittlement is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 1E17 n/cm^2 (E >1 MeV) at the end of the license renewal term. The TLAA is to evaluate the impact of neutron embrittlement on: (a) the RT_{PTS} value based on the requirements in 10 CFR 50.61, (b) the adjusted reference temperature values used for calculation of the plant's pressure-temperature limits, and (c) the Charpy upper shelf energy or the equivalent margins analyses performed in accordance with 10 CFR Part 50, Appendix G requirements. See the Standard Review Plan, Section 4.2 "Reactor Vessel Neutron Embrittlement" for acceptable methods for meeting the requirements of 10 CFR 54.21(c).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
A2 Reactor Vessel (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.A2-24 (R-86)	IV.A2.5-c	Vessel shell Upper shell Intermediate and lower shell (including beltline welds)	Steel with stainless steel cladding	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement	Chapter XI.M31, "Reactor Vessel Surveillance"	No
IV.A2-25 (R-87)	IV.A2.5-f	Vessel shell Vessel flange	Steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No

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B1. REACTOR VESSEL INTERNALS (BOILING WATER REACTOR)

Systems, Structures, and Components

This section addresses the boiling water reactor (BWR) vessel internals and consists of the core shroud (including repairs) and core plate, the top guide, feedwater spargers, core spray lines and spargers, jet pump assemblies, fuel supports and control rod drive (CRD), and instrument housings, such as the intermediate range monitor (IRM) dry tubes, the low power range monitor (LPRM) dry tubes, and the source range monitor (SRM) dry tubes. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all structures and components that comprise the reactor vessel are governed by Group A or B Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the reactor vessel internals include the reactor pressure vessel (IV.A1) and the reactor coolant pressure boundary (IV.C1).

IV	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM						
B1	Reactor Vessel Internals (BWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B1-1 (R-92)	IV.B1.1-a	Core shroud (including repairs) and core plate Core shroud (upper, central, lower)	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for core shroud and Chapter XI.M2, "Water Chemistry" for BWR water	No
IV.B1-2 (R-96)	IV.B1.1-f	Core shroud (including repairs) and core plate Shroud support structure (shroud support cylinder, shroud support plate, shroud support legs)	Nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for shroud support and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.B1-3 (R-97)	IV.B1.1-g	Core shroud and core plate LPCI coupling	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for the LPCI coupling and Chapter XI.M2, "Water Chemistry," for BWR water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B1 Reactor Vessel Internals (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B1-4 (R-95)	IV.B1.1-e	Core shroud and core plate Access hole cover (mechanical covers)	Nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.B1-5 (R-94)	IV.B1.1-d	Core shroud and core plate Access hole cover (welded covers)	Nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for BWR water Because cracking initiated in crevice regions is not amenable to visual inspection, for BWRs with a crevice in the access hole covers, an augmented inspection is to include ultrasonic testing (UT) or other demonstrated acceptable inspection of the access hole cover welds.	No
IV.B1-6 (R-93)	IV.B1.1-b	Core shroud and core plate Core plate Core plate bolts (used in early BWRs)	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for core plate and Chapter XI.M2, "Water Chemistry" for BWR water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B1 Reactor Vessel Internals (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B1-7 (R-99)	IV.B1.3-a	Core spray lines and spargers Core spray lines (headers) Spray rings Spray nozzles Thermal sleeves	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for core spray internals and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.B1-8 (R-104)	IV.B1.5-c	Fuel supports and control rod drive assemblies Control rod drive housing	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for lower plenum and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.B1-9 (R-103)	IV.B1.5-a	Fuel supports and control rod drive assemblies Orificed fuel support	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B1 Reactor Vessel Internals (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B1-10 (R-105)	IV.B1.6-a	Instrumentation Intermediate range monitor (IRM) dry tubes Source range monitor (SRM) dry tubes Incore neutron flux monitor guide tubes	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for lower plenum and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.B1-11 (R-101)	IV.B1.4-c	Jet pump assemblies Castings	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
IV.B1-12 (R-102)	IV.B1.4-d	Jet pump assemblies Jet pump sensing line	Stainless steel	Reactor coolant	Cracking/ cyclic loading	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

IV B1	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Vessel Internals (BWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B1-13 (R-100)	IV.B1.4-a	Jet pump assemblies Thermal sleeve Inlet header Riser brace arm Holddown beams Inlet elbow Mixing assembly Diffuser Castings	Nickel alloy; stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for jet pump assembly and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.B1-14 (R-53)	IV.B1.6-b IV.B1.3-b IV.B1.4-b IV.B1.2-b IV.B1.5-b IV.B1.1-c	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.B1-15 (RP-26)	IV.B1.	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry" for BWR water	No
IV.B1-16 (RP-18)	IV.B1.	Steam Dryers	Stainless steel	Reactor coolant	Cracking/ flow-induced vibration	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B1 Reactor Vessel Internals (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B1-17 (R-98)	IV.B1.2-a	Top guide	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, "BWR Vessel Internals," for top guide and Chapter XI.M2, "Water Chemistry," for BWR water. Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>IMeV) prior to the period of extended operation, inspect five percent (5%) of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation. An additional 5% of the top guide locations will be inspected within twelve years after entering the period of extended operation. Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5% of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5% of the top guide locations will be inspected within twelve years after the date projected for exceeding the threshold. The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold.	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B1 Reactor Vessel Internals (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
						The extent and frequency of examination of the top guide is similar to the examination of the control rod drive housing guide tube in BWRVIP-47.	

B2. REACTOR VESSEL INTERNALS (PWR) - WESTINGHOUSE

Systems, Structures, and Components

This section addresses the Westinghouse pressurized water reactor (PWR) vessel internals and consists of the upper internals assembly, the rod control cluster assemblies (RCCA) guide tube assemblies, the core barrel, the baffle/former assembly, the lower internal assembly, and the instrumentation support structures. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all structures and components that comprise the reactor vessel are governed by Group A or B Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the reactor vessel internals include the reactor pressure vessel (IV.A2).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-1 (R-124)	IV.B2.4-b	Baffle/former assembly Baffle and former plates	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-2 (R-123)	IV.B2.4-a	Baffle/former assembly Baffle and former plates	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-3 (R-127)	IV.B2.4-e	Baffle/former assembly Baffle and former plates	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-4 (R-126)	IV.B2.4-d	Baffle/former assembly Baffle/former bolts	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-5 (R-129)	IV.B2.4-h	Baffle/former assembly Baffle/former bolts	Stainless steel	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-6 (R-128)	IV.B2.4-f	Baffle/former assembly Baffle/former bolts and screws	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-7 (R-121)	IV.B2.3-b	Core barrel Core barrel (CB) CB flange (upper) CB outlet nozzles Thermal shield	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2 Reactor Vessel Internals (PWR) - Westinghouse							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B2-8 (R-120)	IV.B2.3-a	Core barrel Core barrel (CB) CB flange (upper) CB outlet nozzles Thermal shield	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-9 (R-122)	IV.B2.3-c	Core barrel Core barrel (CB) CB flange (upper) CB outlet nozzles Thermal shield	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-10 (R-125)	IV.B2.4-c	Core barrel assembly Baffle/former assembly Baffle/former bolts and screws	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-11 (R-144)	IV.B2.6-b	Instrumentation support structures Flux thimble guide tubes	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-12 (R-143)	IV.B2.6-a	Instrumentation support structures Flux thimble guide tubes	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-13 (R-145)	IV.B2.6-c	Instrumentation support structures Flux thimble tubes	Stainless steel with or without chrome plating	Reactor coolant	Loss of material/ wear	Chapter XI.M37, “Flux Thimble Tube Inspection"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B2-14 (R-137)	IV.B2.5-i	Lower internal assembly Clevis insert bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-15 (R-134)	IV.B2.5-f	Lower internal assembly Fuel alignment pins Lower support plate column bolts Clevis insert bolts	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-16 (R-133)	IV.B2.5-e	Lower internal assembly Fuel alignment pins Lower support plate column bolts Clevis insert bolts	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-17 (R-135)	IV.B2.5-g	Lower internal assembly Fuel alignment pins Lower support plate column bolts Clevis insert bolts	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-18 (R-132)	IV.B2.5-c	Lower internal assembly Lower core plate	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-19 (R-131)	IV.B2.5-b	Lower internal assembly Lower core plate Radial keys and clevis inserts	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-20 (R-130)	IV.B2.5-a	Lower internal assembly Lower core plate Radial keys and clevis inserts	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-21 (R-140)	IV.B2.5-m	Lower internal assembly Lower support casting Lower support plate columns	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-22 (R-141)	IV.B2.5-n	Lower internal assembly Lower support forging Lower support plate columns	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-23 (R-139)	IV.B2.5-l	Lower internal assembly Lower support forging or casting Lower support plate columns	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-24 (R-138)	IV.B2.5-k	Lower internal assembly Lower support forging or casting Lower support plate columns	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2 Reactor Vessel Internals (PWR) - Westinghouse							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B2-25 (R-136)	IV.B2.5-h	Lower internal assembly Lower support plate column bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-26 (R-142)	IV.B2.5-o	Lower internal assembly Radial keys and clevis Inserts	Stainless steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-27 (R-119)	IV.B2.2-e	RCCA guide tube assemblies RCCA guide tube bolts RCCA guide tube support pins	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B2 Reactor Vessel Internals (PWR) - Westinghouse							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B2-28 (R-118)	IV.B2.2-d	RCCA guide tube assemblies RCCA guide tube bolts RCCA guide tube support pins	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM						
B2	Reactor Vessel Internals (PWR) - Westinghouse						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B2-29 (R-117)	IV.B2.2-b	RCCA guide tube assemblies RCCA guide tubes	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM						
B2	Reactor Vessel Internals (PWR) - Westinghouse						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B2-30 (R-116)	IV.B2.2-a	RCCA guide tube assemblies RCCA guide tubes	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-31 (R-53)	IV.B2.1-m IV.B2.2-f IV.B2.1-c IV.B2.2-c IV.B2.3-d IV.B2.4-g IV.B2.5-p IV.B2.5-j IV.B2.5-d IV.B2.1-h	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-32 (RP-24)	IV.B2.	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
IV.B2-33 (R-108)	IV.B2.1-d	Upper internals assembly Hold-down spring	Stainless steel	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-34 (R-115)	IV.B2.1-l	Upper internals assembly Upper core plate alignment pins	Stainless steel; nickel alloy	Reactor coolant	Loss of material/ wear	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-35 (R-110)	IV.B2.1-f	Upper internals assembly Upper support column	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-36 (R-109)	IV.B2.1-e	Upper internals assembly Upper support column	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-37 (R-111)	IV.B2.1-g	Upper internals assembly Upper support column (only cast austenitic stainless steel portions)	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

IV B2	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Vessel Internals (PWR) - Westinghouse						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B2-38 (R-114)	IV.B2.1-k	Upper internals assembly Upper support column bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B2-39 (R-113)	IV.B2.1-j	Upper internals assembly Upper support column bolts Upper core plate alignment pins Fuel alignment pins	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-40 (R-112)	IV.B2.1-i	Upper internals assembly Upper support column bolts Upper core plate alignment pins Fuel alignment pins	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-41 (R-107)	IV.B2.1-b	Upper internals assembly Upper support plate Upper core plate Hold-down spring	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B2 Reactor Vessel Internals (PWR) - Westinghouse

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B2-42 (R-106)	IV.B2.1-a	Upper internals assembly Upper support plate Upper core plate Hold-down spring	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

B3. REACTOR VESSEL INTERNALS (PWR) - COMBUSTION ENGINEERING

Systems, Structures, and Components

This section addresses the Combustion Engineering pressurized water reactor (PWR) vessel internals and consists of the upper internals assembly, the control element assembly (CEA), shroud assemblies, the core support barrel, the core shroud assembly, and the lower internal assembly. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all structures and components that comprise the reactor vessel are governed by Group A or B Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the reactor vessel internals include the reactor pressure vessel (IV.A2).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-1 (R-153)	IV.B3.2-e	CEA shroud assemblies	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
IV.B3-2 (R-149)	IV.B3.2-a	CEA shroud assemblies	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B3-3 (R-152)	IV.B3.2-d	CEA shroud assemblies CEA shroud extension shaft guides	Stainless steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-4 (R-151)	IV.B3.2-c	CEA shroud assemblies CEA shrouds bolts	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-5 (R-150)	IV.B3.2-b	CEA shroud assemblies CEA shrouds bolts	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water. No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV B3	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Vessel Internals (PWR) - Combustion Engineering						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B3-6 (R-154)	IV.B3.2-g	CEA shroud assemblies CEA shrouds bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B3-7 (R-165)	IV.B3.4-h	Core shroud assembly Core shroud assembly bolts Core shroud tie rods	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B3 Reactor Vessel Internals (PWR) - Combustion Engineering							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B3-8 (R-163)	IV.B3.4-f	Core shroud assembly Core shroud assembly bolts (later plants are welded)	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-9 (R-162)	IV.B3.4-e	Core shroud assembly Core shroud assembly bolts (later plants are welded)	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-10 (R-164)	IV.B3.4-g	Core shroud assembly Core shroud assembly bolts (later plants are welded)	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-11 (R-159)	IV.B3.4-a	Core shroud assembly Core shroud tie rods (core support plate attached by welds in later plants)	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-12 (R-161)	IV.B3.4-c	Core shroud assembly Core shroud tie rods (core support plate attached by welds in later plants)	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B3-13 (R-160)	IV.B3.4-b	Core shroud assembly Core shroud tie rods (core support plate attached by welds in later plants)	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-14 (R-158)	IV.B3.3-b	Core support barrel Core support barrel upper flange	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-15 (R-155)	IV.B3.3-a	Core support barrel Core support barrel upper flange	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-16 (R-157)	IV.B3.3-a	Core support barrel Core support barrel upper flange	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B3-17 (R-156)	IV.B3.3-b	Core support barrel Core support barrel upper flange Core support barrel alignment keys	Stainless steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components	No
IV.B3-18 (R-171)	IV.B3.5-f	Lower internal assembly Core support column	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)”	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-19 (R-168)	IV.B3.5-c	Lower internal assembly Core support plate Fuel alignment pins Lower support structure beam assemblies Core support column bolts Core support barrel snubber assemblies	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-20 (R-169)	IV.B3.5-d	Lower internal assembly Core support plate Fuel alignment pins Lower support structure beam assemblies Core support column bolts Core support barrel snubber assemblies	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-21 (R-166)	IV.B3.5-a	Lower internal assembly Core support plate Lower support structure beam assemblies Core support column Core support barrel snubber assemblies	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B3-22 (R-170)	IV.B3.5-e	Lower internal assembly Fuel alignment pins Core support barrel snubber assemblies	Stainless steel; nickel alloy	Reactor coolant	Loss of material/ wear	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-23 (R-167)	IV.B3.5-b	Lower internal Assembly Fuel alignment pins Core support column bolts	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B3-24 (R-53)	IV.B3.4-d IV.B3.5-g IV.B3.2-f	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.B3-25 (RP-24)	IV.B3.	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” for PWR primary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B3 Reactor Vessel Internals (PWR) - Combustion Engineering

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B3-26 (R-148)	IV.B3.1-c	Upper internals assembly Fuel alignment plate Fuel alignment plate guide lugs and their lugs Hold-down ring	Stainless steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No
IV.B3-27 (R-147)	IV.B3.1-b	Upper internals assembly Upper guide structure support plate Fuel alignment plate Fuel alignment plate guide lugs and guide lug inserts	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B3 Reactor Vessel Internals (PWR) - Combustion Engineering							
IV.B3-28 (R-146)	IV.B3.1-a	Upper internals assembly Upper guide structure support plate Fuel alignment plate Fuel alignment plate guide lugs and guide lug inserts	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

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B4. REACTOR VESSEL INTERNALS (PWR) - BABCOCK AND WILCOX

Systems, Structures, and Components

This section addresses the Babcock and Wilcox pressurized water reactor (PWR) vessel internals and consists of the plenum cover and plenum cylinder, the upper grid assembly, the control rod guide tube (CRGT) assembly, the core support shield assembly, the core barrel assembly, the lower grid assembly, and the flow distributor assembly. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all structures and components that comprise the reactor vessel are governed by Group A or B Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the reactor vessel internals include the reactor pressure vessel (IV.A2).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-1 (R-128)	IV.B4.5-i	Baffle/former assembly Baffle/former bolts and screws	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-2 (R-180)	IV.B4.3-a	Control rod guide tube (CRGT) assembly CRGT pipe and flange CRGT spacer casting CRGT rod guide tubes CRGT rod guide sectors	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-3 (R-182)	IV.B4.3-c	Control rod guide tube (CRGT) assembly CRGT pipe and flange CRGT spacer casting CRGT spacer screws Flange-to-upper grid screws CRGT rod guide tubes CRGT rod guide sectors	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-4 (R-183)	IV.B4.3-d	Control rod guide tube (CRGT) assembly CRGT spacer casting	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-5 (R-181)	IV.B4.3-b	Control rod guide tube (CRGT) assembly CRGT spacer screws Flange-to-upper grid screws	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-6 (R-184)	IV.B4.3-e	Control rod guide tube (CRGT) assembly Flange-to-upper grid screws	Stainless steel	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-7 (R-125)	IV.B4.5-g	Core barrel assembly Baffle/former assembly Baffle/former bolts and screws	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-8 (R-199)	IV.B4.5-h	Core barrel assembly Baffle/former bolts and screws	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-9 (R-201)	IV.B4.5-j	Core barrel assembly Baffle/former bolts and screws	Stainless steel	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-10 (R-193)	IV.B4.5-a	Core barrel assembly Core barrel cylinder (top and bottom flange) Baffle plates and formers	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-11 (R-195)	IV.B4.5-c	Core barrel assembly Core barrel cylinder (top and bottom flange) Lower internals assembly-to-core barrel bolts Core barrel-to-thermal shield bolts Baffle plates and formers	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-12 (R-196)	IV.B4.5-d	Core barrel assembly Core barrel cylinder (top and bottom flange) Lower internals assembly-to-core barrel bolts Core barrel-to-thermal shield bolts Baffle plates and formers	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-13 (R-194)	IV.B4.5-b	Core barrel assembly Lower internals assembly-to-core barrel bolts Core barrel-to-thermal shield bolts	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-14 (R-197)	IV.B4.5-e	Core barrel assembly Lower internals assembly-to-core barrel bolts Core barrel-to-thermal shield bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-15 (R-190)	IV.B4.4-f	Core support shield assembly Core support shield cylinder (top flange) vent valve assembly locking device	Stainless steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-16 (R-188)	IV.B4.4-d	Core support shield assembly Core support shield cylinder (top and bottom flange) Core support shield-to-core barrel bolts Outlet and vent valve nozzles vent valve assembly locking device	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-17 (R-187)	IV.B4.4-c	Core support shield assembly Core support shield cylinder (top and bottom flange) Core support shield-to-core barrel bolts vent valve retaining ring vent valve assembly locking device	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-18 (R-185)	IV.B4.4-a	Core support shield assembly Core support shield cylinder (top and bottom flange) Outlet and vent valve nozzles vent valve body and retaining ring	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-19 (R-192)	IV.B4.4-h	Core support shield assembly Core support shield-to-core barrel bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-20 (R-186)	IV.B4.4-b	Core support shield assembly Core support shield-to-core barrel bolts vent valve assembly locking device	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-21 (R-191)	IV.B4.4-g	Core support shield assembly Outlet and vent valve nozzles vent valve body and retaining ring	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)”	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-22 (R-209)	IV.B4.7-a	Flow distributor assembly Flow distributor head and flange Incore guide support plate Clamping ring	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-23 (R-211)	IV.B4.7-c	Flow distributor assembly Flow distributor head and flange Shell forging-to-flow distributor bolts Incore guide support plate Clamping ring	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-24 (R-212)	IV.B4.7-d	Flow distributor assembly Flow distributor head and flange Shell forging-to-flow distributor bolts Incore guide support plate Clamping ring	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV B4	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Vessel Internals (PWR) – Babcock & Wilcox						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-25 (R-210)	IV.B4.7-b	Flow distributor assembly Shell forging-to-flow distributor bolts	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-26 (R-213)	IV.B4.7-e	Flow distributor assembly Shell forging-to-flow distributor bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-27 (R-208)	IV.B4.6-h	Lower grid assembly Fuel assembly support pads Guide blocks	Stainless steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No
IV.B4-28 (R-206)	IV.B4.6-e	Lower grid assembly Incore guide tube spider castings	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F) and neutron flux	Loss of fracture toughness/ thermal aging and neutron irradiation embrittlement	Chapter XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-29 (R-202)	IV.B4.6-a	Lower grid assembly Lower grid rib section Fuel assembly support pads Lower grid flow dist. plate Orifice plugs Lower grid and shell forgings Guide blocks Shock pads Support post pipes Incore guide tube spider castings	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-30 (R-204)	IV.B4.6-c	Lower grid assembly Lower grid rib section Fuel assembly support pads Lower grid rib-to-shell forging screws Lower grid flow dist. plate Orifice plugs Lower grid and shell forgings Lower internals assembly-to-thermal shield bolts Guide blocks and bolts Shock pads and bolts Support post pipes Incore guide tube spider castings	Stainless steel; nickel alloy	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-31 (R-205)	IV.B4.6-d	Lower grid assembly Lower grid rib section Fuel assembly support pads Lower grid rib-to-shell forging screws Lower grid flow dist. plate Orifice plugs Lower grid and shell forgings Lower internals assembly-to-thermal shield bolts Guide blocks and bolts Shock pads and bolts Support post pipes	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-32 (R-203)	IV.B4.6-b	Lower grid assembly Lower grid rib-to-shell forging screws Lower internals assembly-to-thermal shield bolts Guide blocks bolts Shock pads bolts	Stainless steel; nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-33 (R-207)	IV.B4.6-g	Lower grid assembly Lower grid rib-to-shell forging screws Lower internals assembly-to-thermal shield bolts	Stainless steel; nickel alloy	Reactor coolant	Loss of preload/ stress relaxation	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-34 (R-172)	IV.B4.1-a	Plenum cover and plenum cylinder Plenum cover assembly Plenum cylinder Reinforcing plates	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-35 (R-174)	IV.B4.1-c	Plenum cover and plenum cylinder Plenum cover assembly Plenum cylinder Reinforcing plates Top flange-to-cover bolts Bottom flange-to-upper grid screws	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-36 (R-173)	IV.B4.1-b	Plenum cover and plenum cylinder Top flange-to-cover bolts Bottom flange-to-upper grid screws	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-37 (R-53)	IV.B4.3-f IV.B4.5-f IV.B4.6-f IV.B4.2-d IV.B4.1-d IV.B4.4-e	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.B4-38 (RP-24)	IV.B4.	Reactor vessel internals components	Stainless steel; nickel alloy	Reactor coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-39 (R-215)	IV.B4.8-b	Thermal shield	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV B4	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Vessel Internals (PWR) – Babcock & Wilcox						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-40 (R-214)	IV.B4.8-a	Thermal shield	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-41 (R-216)	IV.B4.8-c	Thermal shield	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-42 (R-179)	IV.B4.2-f	Upper grid assembly Fuel assembly support pads Plenum rib pads	Stainless steel	Reactor coolant	Loss of material/ wear	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.B4-43 (R-176)	IV.B4.2-b	Upper grid assembly Rib- to-ring screws	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM B4 Reactor Vessel Internals (PWR) – Babcock & Wilcox							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-44 (R-175)	IV.B4.2-a	Upper grid assembly Upper grid rib section Upper grid ring forging Fuel assembly support pads Plenum rib pads	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

IV	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM						
B4	Reactor Vessel Internals (PWR) – Babcock & Wilcox						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.B4-45 (R-177)	IV.B4.2-c	Upper grid assembly Upper grid rib section Upper grid ring forging Fuel assembly support pads Plenum rib pads Rib-to-ring screws	Stainless steel	Reactor coolant	Changes in dimensions/ void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed
IV.B4-46 (R-178)	IV.B4.2-e	Upper grid assembly Upper grid rib section Upper grid ring forging Fuel assembly support pads Plenum rib pads Rib-to-ring screws	Stainless steel	Reactor coolant and neutron flux	Loss of fracture toughness/ neutron irradiation embrittlement, void swelling	No further aging management review is necessary if the applicant provides a commitment in the FSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	No, but licensee commitment needs to be confirmed

C1. REACTOR COOLANT PRESSURE BOUNDARY (BOILING WATER REACTOR)

Systems, Structures, and Components

This section addresses the boiling water reactor (BWR) primary coolant pressure boundary and consists of the reactor coolant recirculation system and portions of other systems connected to the pressure vessel extending to the second containment isolation valve or to the first anchor point outside containment. The connected systems include the residual heat removal (RHR), low–pressure core spray (LPCS), high–pressure core spray (HPCS), low–pressure coolant injection (LPCI), high–pressure coolant injection (HPCI), reactor core isolation cooling (RCIC), isolation condenser (IC), reactor water cleanup (RWC), standby liquid control (SLC), feedwater (FW), and main steam (MS) systems; and the steam line to the HPCI and RCIC pump turbines. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all systems, structures, and components that comprise the reactor coolant pressure boundary are governed by Group A Quality Standards.

Pump and valve internals 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. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the reactor coolant pressure boundary include the reactor pressure vessel (IV.A1), the emergency core cooling system (V.D2), the standby liquid control system (VII.E2), the reactor water cleanup system (VII.E3), the shutdown cooling system (older plants) (VII.E4), the main steam system (VIII.B2), and the feedwater system (VIII.D2).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C1 Reactor Coolant Pressure Boundary (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C1-1 (R-03)	IV.C1.1-i	Class 1 piping, fittings and branch connections < nominal pipe sizes (NPS) 4	Stainless steel; steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal and mechanical loading	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components, and Chapter XI.M2, “Water Chemistry,” for BWR water and XI.M35, "One-Time Inspection of ASME Code Class 1 Small-bore Piping"	No
IV.C1-2 (R-52)	IV.C1.1-g	Class 1 piping, piping components, and piping elements	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F)	Loss of fracture toughness/ thermal aging embrittlement	Chapter XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)”	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C1 Reactor Coolant Pressure Boundary (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C1-3 (R-08)	IV.C1.2-c IV.C1.3-b	Class 1 pump casings, and valve bodies and bonnets	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F)	Loss of fracture toughness/ thermal aging embrittlement	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary. The ASME Section XI inspection requirements are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS pump casings and valve bodies. Alternatively, the requirements of ASME Code Case N-481 for pump casings are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS pump casings.	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C1 Reactor Coolant Pressure Boundary (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C1-4 (R-15)	IV.C1.4-a	Isolation condenser components	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for BWR water. The AMP in Chapter XI.M1 is to be augmented to detect cracking due to stress corrosion cracking and verification of the program's effectiveness is necessary to 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 is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes, detection of aging effects is to be evaluated

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C1 Reactor Coolant Pressure Boundary (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C1-5 (R-225)	IV.C1.4-a	Isolation condenser components	Stainless steel; steel	Reactor coolant	Cracking/ cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components The AMP in Chapter XI.M1 is to be augmented to detect cracking due to cyclic loading and verification of the program's effectiveness is necessary to 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 is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes, detection of aging effects is to be evaluated
IV.C1-6 (R-16)	IV.C1.4-b	Isolation condenser components	Stainless steel; steel	Reactor coolant	Loss of material/ general (steel only), pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
IV.C1-7 (R-23)	IV.C1.1-c IV.C1.1-a IV.C1.3-a	Piping, piping components, and piping elements	Steel	Reactor coolant	Wall thinning/ flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C1 Reactor Coolant Pressure Boundary (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C1-8 (R-21)	IV.C1.1-f	Piping, piping components, and piping elements greater than or equal to 4 NPS	Nickel alloy	Reactor coolant	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.C1-9 (R-20)	IV.C1.2-b IV.C1.1-f IV.C1.3-c	Piping, piping components, and piping elements greater than or equal to 4 NPS	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water	No
IV.C1-10 (R-27)	IV.C1.2-e IV.C1.3-f	Pump and valve closure bolting	Low-alloy steel SA 193 Gr. B7	System temperature up to 288°C (550°F)	Loss of preload/ thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No
IV.C1-11 (R-28)	IV.C1.2-f IV.C1.3-g	Pump and valve closure bolting	Steel	System temperature up to 288°C (550°F)	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation; check ASME Code limits for allowable cycles (less than 7000 cycles) of thermal stress range. See the Standard Review Plan, Section 4.3, "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.C1-12 (R-26)	IV.C1.3-e IV.C1.2-d	Pump and valve closure bolting	Steel	System temperature up to 288°C (550°F)	Loss of material/ wear	Chapter XI.M18, "Bolting Integrity"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C1 Reactor Coolant Pressure Boundary (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C1-13 (R-29)	IV.C1.2-d IV.C1.3-e	Pump and valve seal flange closure bolting	Stainless steel; steel	System temperature up to 288°C (550°F)	Loss of material/ wear	Chapter XI.M18, “Bolting Integrity”	No
IV.C1-14 (RP-27)	IV.C1.	Reactor coolant pressure boundary components	Steel with stainless steel or nickel alloy cladding; stainless steel; nickel alloy	Reactor coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
IV.C1-15 (R-220)	IV.C1.1-e IV.C1.1-b IV.C1.1-h IV.C1.3-d IV.C1.1-e IV.C1.1-h IV.C1.1-d IV.C1.1-h IV.C1.2-a IV.C1.2-a IV.C1.1-h IV.C1.2-a IV.C1.1-h IV.C1.1-h IV.C1.3-d IV.C1.1-h IV.C1.3-d	Reactor coolant pressure boundary components: Piping, piping components, and piping elements	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

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C2. REACTOR COOLANT SYSTEM AND CONNECTED LINES (PRESSURIZED WATER REACTOR)

Systems, Structures, and Components

This section addresses the pressurized water reactor (PWR) primary coolant pressure boundary and consists of the reactor coolant system and portions of other connected systems generally extending up to and including the second containment isolation valve or to the first anchor point and including the containment isolation valves, the reactor coolant pump, valves, pressurizer, and the pressurizer relief tank. The connected systems include the residual heat removal (RHR) or low pressure injection system, high pressure injection system, sampling system, and the small-bore piping. With respect to other systems such as the core flood system (CFS) or the safety injection tank (SIT) and the chemical and volume control system (CVCS), the isolation valves associated with the boundary between ASME Code class 1 and 2 are located inside the containment. Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” and with the exception of the pressurizer relief tank, which is governed by Group B Quality Standards, all systems, structures, and components that comprise the reactor coolant system are governed by Group A Quality Standards. The recirculating pump seal water heat exchanger is discussed in V.D1.

Pump and valve internals 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. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the reactor coolant pressure boundary include the reactor pressure vessel (IV.A2), the steam generators (IV.D1 and IV.D2), the emergency core cooling system (V.D1), and the chemical and volume control system (VII.E1).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-1 (R-02)	IV.C2.1-g IV.C2.2-h	Class 1 piping, fittings and branch connections < NPS 4	Stainless steel; steel with stainless steel cladding	Reactor coolant	Cracking/ stress corrosion cracking, thermal and mechanical loading	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components, and Chapter XI.M2, “Water Chemistry,” for PWR water and XI.M35, "One-Time Inspection of ASME Code Class 1 Small-bore Piping"	No
IV.C2-2 (R-07)	IV.C2.5-h IV.C2.5-m IV.C2.2-f	Class 1 piping, fittings, primary nozzles, safe ends, manways, and flanges	Stainless steel; steel with stainless steel cladding	Reactor coolant	Cracking/ stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components and Chapter XI.M2, “Water Chemistry,” for PWR primary water	No

IV	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM						
C2	Reactor Coolant System and Connected Lines (PWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.C2-3 (R-05)	IV.C2.2-g IV.C2.5-i IV.C2.1-e	Class 1 piping, piping components, and piping elements	Cast austenitic stainless steel	Reactor coolant	Cracking/ stress corrosion cracking	Monitoring and control of primary water chemistry in accordance with the guidelines in EPRI TR-105714 (Rev. 3 or later) minimize the potential of SCC, and material selection according to NUREG-0313, Rev. 2 guidelines of =0.035% C and =7.5% ferrite reduces susceptibility to SCC. For CASS components that do not meet either one of the above guidelines, a plant-specific aging management program is to be evaluated. The program is to include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement.	Yes, plant-specific
IV.C2-4 (R-52)	IV.C2.5-l IV.C2.1-f IV.C2.2-e	Class 1 piping, piping components, and piping elements	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F)	Loss of fracture toughness/ thermal aging embrittlement	Chapter XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)”	No
IV.C2-5 (R-09)	IV.C2.3-b IV.C2.4-b	Class 1 pump casings and valve bodies	Stainless steel; steel with stainless steel cladding	Reactor coolant	Cracking/ stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components and Chapter XI.M2, “Water Chemistry,” for PWR primary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-6 (R-08)	IV.C2.3-c IV.C2.4-c	Class 1 pump casings, and valve bodies and bonnets	Cast austenitic stainless steel	Reactor coolant >250°C (>482°F)	Loss of fracture toughness/ thermal aging embrittlement	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary. The ASME Section XI inspection requirements are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS pump casings and valve bodies. Alternatively, the requirements of ASME Code Case N-481 for pump casings are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS pump casings.	No
IV.C2-7 (R-11)	IV.C2.5-n IV.C2.3-e IV.C2.4-e	Closure bolting	High-strength low-alloy steel, stainless steel	Air with reactor coolant leakage	Cracking/ stress corrosion cracking	Chapter XI.M18, “Bolting Integrity”	No
IV.C2-8 (R-12)	IV.C2.4-g IV.C2.5-p IV.C2.3-g	Closure bolting	Low-alloy steel, stainless steel	Air with reactor coolant leakage	Loss of preload/ thermal effects, gasket creep, and self-loosening	Chapter XI.M18, “Bolting Integrity”	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-9 (R-17)	IV.C2.3-f IV.C2.2-d IV.C2.1-d IV.C2.5-b IV.C2.5-u IV.C2.6-b IV.C2.4-f IV.C2.5-o	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
IV.C2-10 (R-18)	IV.C2.5-w IV.C2.3-d IV.C2.4-d IV.C2.5-t	Piping and components external surfaces and bolting	Stainless steel; steel	System temperature up to 340°C (644°F)	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.C2-11 (RP-11)	IV.C2.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
IV.C2-12 (RP-12)	IV.C2.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-13 (RP-31)	IV.C2.	Piping, piping components, and piping elements	Nickel alloy	Reactor coolant/ steam	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry" for PWR primary water and Comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed
IV.C2-14 (RP-10)	IV.C2.	Piping, piping components, and piping elements	Steel	Closed cycle cooling water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
IV.C2-15 (RP-23)	IV.C2.	Piping, piping components, and piping elements; flanges; heater sheaths and sleeves; penetrations; thermal sleeves; vessel shell heads and welds	Steel with stainless steel or nickel alloy cladding; stainless steel; nickel alloy	Reactor coolant	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No

IV C2	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Coolant System and Connected Lines (PWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.C2-16 (R-19)	IV.C2.5-v	Pressurizer Integral support	Stainless steel; steel	Air with metal temperature up to 288°C (550°F)	Cracking/ cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No
IV.C2-17 (R-24)	IV.C2.5-j	Pressurizer Spray head	Nickel alloy; stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32 "One-Time Inspection" and For nickel alloy welded spray heads, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, unless licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-18 (R-58)	IV.C2.5-c IV.C2.5-g	Pressurizer components	Steel with stainless steel or nickel alloy cladding; or stainless steel	Reactor coolant	Cracking/ cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water Cracks in the pressurizer cladding could propagate from cyclic loading into the ferrite base metal and weld metal. However, because the weld metal between the surge nozzle and the vessel lower head is subjected to the maximum stress cycles and the area is periodically inspected as part of the ISI program, the existing AMP is adequate for managing the effect of pressurizer clad cracking.	No
IV.C2-19 (R-25)	IV.C2.5-g IV.C2.5-c	Pressurizer components	Steel with stainless steel or nickel alloy cladding; or stainless steel	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry," for PWR primary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-20 (R-217)	IV.C2.5-r	Pressurizer heater sheaths and sleeves, and heater bundle diaphragm plate	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water	No
IV.C2-21 (R-06)	IV.C2.5-m IV.C2.5-k IV.C2.5-s	Pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges	Nickel alloy or nickel alloy cladding	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry," for PWR primary water and For nickel alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed
IV.C2-22 (R-14)	IV.C2.6-c	Pressurizer relief tank Tank shell and heads Flanges and nozzles	Stainless steel; steel with stainless steel cladding	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water	No

IV C2	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Reactor Coolant System and Connected Lines (PWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.C2-23 (R-13)	IV.C2.6-a	Pressurizer relief tank Tank shell and heads Flanges and nozzles	Steel with stainless steel cladding	Treated borated water	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.C2-24 (RP-22)	IV.C2.	Pressurizer surge and steam space nozzles, and welds	Nickel alloy	Reactor coolant/ steam	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry," for PWR primary water and Comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-25 (R-223)	IV.C2.5-f IV.C2.4-a IV.C2.2-a IV.C2.5-f IV.C2.3-a IV.C2.2-b IV.C2.1-b IV.C2.1-b IV.C2.5-a IV.C2.1-a IV.C2.1-a IV.C2.5-d IV.C2.2-a IV.C2.2-a IV.C2.4-a IV.C2.2-b IV.C2.3-a IV.C2.5-q IV.C2.2-c IV.C2.5-d IV.C2.5-e IV.C2.5-f IV.C2.2-a	Reactor coolant pressure boundary components: Piping, piping components, and piping elements; Flanges; Nozzles and safe ends; Pressurizer vessel shell heads and welds; Heater sheaths and sleeves; Penetrations; and Thermal sleeves	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
C2 Reactor Coolant System and Connected Lines (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.C2-26 (R-56)	IV.C2.1-c	Reactor coolant system piping and fittings Cold leg Hot leg Surge line Spray line	Stainless steel; steel with stainless steel cladding	Reactor coolant	Cracking/ cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components	No
IV.C2-27 (R-30)	IV.C2.1-c	Reactor coolant system piping and fittings Cold leg Hot leg Surge line Spray line	Stainless steel; steel with stainless steel cladding	Reactor coolant	Cracking/ stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components and Chapter XI.M2, "Water Chemistry," for PWR primary water	No

D1. STEAM GENERATOR (RECIRCULATING)

Systems, Structures, and Components

This section addresses the recirculating-type steam generators, as found in Westinghouse and Combustion Engineering pressurized water reactors (PWRs), including all internal components and water/steam nozzles and safe ends. Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” the primary water side (tube side) of the steam generator is governed by Group A Quality Standards, and the secondary water side is governed by Group B Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the steam generators include the reactor coolant system and connected lines (IV.C2), the containment isolation components (V.C), the main steam system (VIII.B1), the feedwater system (VIII.D1), the steam generator blowdown system (VIII.F), and the auxiliary feedwater system (VIII.G).

IV D1	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Steam Generator (Recirculating)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.D1-1 (R-07)	IV.D1.1-i	Class 1 piping, fittings, primary nozzles, safe ends, manways, and flanges	Stainless steel; steel with stainless steel cladding	Reactor coolant	Cracking/ stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components and Chapter XI.M2, “Water Chemistry,” for PWR primary water	No
IV.D1-2 (R-10)	IV.D1.1-l	Closure bolting	Steel	Air with reactor coolant leakage	Cracking/ stress corrosion cracking	Chapter XI.M18, “Bolting Integrity”	No
IV.D1-3 (R-17)	IV.D1.1-k IV.D1.1-g	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No
IV.D1-4 (R-01)	IV.D1.1-i IV.D1.1-j	Instrument penetrations and primary side nozzles, safe ends, and welds	Nickel alloy; steel with nickel-alloy cladding	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components, and Chapter XI.M2, “Water Chemistry,” for PWR primary water and For nickel alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to submit a plant-specific AMP to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed

IV D1	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Steam Generator (Recirculating)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.D1-5 (R-37)	IV.D1.1-d	Pressure boundary and structural Steam nozzle and safe end FW nozzle and safe end	Steel	Secondary feedwater/ steam	Wall thinning/ flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
IV.D1-6 (RP-21)	IV.D1.	Primary side Divider Plate	Nickel alloy; steel with nickel-alloy cladding	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
IV.D1-7 (RP-17)	IV.D1.	Primary side Divider Plate	Stainless steel	Reactor coolant	Cracking/ stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
IV.D1-8 (R-221)	IV.D1.1-h	Recirculating steam generator components: Flanges; Penetrations; Nozzles; Safe ends, lower heads and welds	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
D1 Steam Generator (Recirculating)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.D1-9 (RP-16)	IV.D1.	Steam generator Tube bundle wrapper	Steel	Secondary feedwater/ steam	Loss of material/ erosion, general, pitting, and crevice corrosion	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D1-10 (R-32)	IV.D1.1-f	Steam generator closure bolting	Steel	System temperature up to 340°C (644°F)	Loss of preload/ thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No
IV.D1-11 (R-33)	IV.D1.1-b IV.D1.1-a	Steam generator components Top head; Steam nozzle and safe end; Upper and lower shell; Feedwater and auxiliary feedwater nozzle and safe end; feedwater impingement plate and support	Steel	Secondary feedwater/ steam	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV D1	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Steam Generator (Recirculating)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.D1-12 (R-34)	IV.D1.1-c	Steam generator components Upper and lower shell, and transition cone	Steel	Secondary feedwater/ steam	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 2 components and Chapter XI.M2, "Water Chemistry," for PWR secondary water. As noted in NRC IN 90-04, if general and pitting corrosion of the shell is known to exist, the AMP guidelines in Chapter XI.M1 may not be sufficient to detect general and pitting corrosion (and the resulting corrosion-fatigue cracking), and additional inspection procedures are to be developed. This issue is limited to Westinghouse Model 44 and 51 Steam Generators where a high stress region exists at the shell to transition cone weld.	Yes, detection of aging effects is to be evaluated
IV.D1-13 (R-39)	IV.D1.1-e	Steam generator feedwater impingement plate and support	Steel	Secondary feedwater	Loss of material/ erosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
IV.D1-14 (RP-14)	IV.D1.	Steam generator structural Anti-vibration bars	Chrome plated steel; stainless steel; Nickel alloy	Secondary feedwater/ steam	Cracking/ stress corrosion cracking	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1 Steam Generator (Recirculating)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.D1-15 (RP-15)	IV.D1.	Steam generator structural Anti-vibration bars	Chrome plated steel; stainless steel; Nickel alloy	Secondary feedwater/ steam	Loss of material/ crevice corrosion and fretting	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D1-16 (R-41)	IV.D1.2-h	Steam generator structural Tube support lattice bars	Steel	Secondary feedwater/ steam	Wall thinning/ flow-accelerated corrosion	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D1-17 (R-42)	IV.D1.2-k	Steam generator structural Tube support plates	Steel	Secondary feedwater/ steam	Ligament cracking/ corrosion	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D1-18 (R-40)	IV.D1.2-j IV.D1.2-i	Tube plugs	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR primary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
D1 Steam Generator (Recirculating)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.D1-19 (R-43)	IV.D1.2-g	Tubes	Nickel alloy	Secondary feedwater/ steam	Denting/ corrosion of carbon steel tube support plate	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water. For plants that could experience denting at the upper support plates, the applicant should evaluate potential for rapidly propagating cracks and then develop and take corrective actions consistent with Bulletin 88-02, "Rapidly Propagating Cracks in SG Tubes."	No
IV.D1-20 (R-44)	IV.D1.2-a	Tubes and sleeves	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR primary water	No
IV.D1-21 (R-46)	IV.D1.2-d	Tubes and sleeves	Nickel alloy	Reactor coolant and secondary feedwater/steam	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.D1-22 (R-48)	IV.D1.2-c	Tubes and sleeves	Nickel alloy	Secondary feedwater/ steam	Cracking/ intergranular attack	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM D1 Steam Generator (Recirculating)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.D1-23 (R-47)	IV.D1.2-b	Tubes and sleeves	Nickel alloy	Secondary feedwater/ steam	Cracking/ outer diameter stress corrosion cracking	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D1-24 (R-49)	IV.D1.2-e	Tubes and sleeves	Nickel alloy	Secondary feedwater/ steam	Loss of material/ fretting and wear	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D1-25 (R-50)	IV.D1.2-f	Tubes and sleeves (exposed to phosphate chemistry)	Nickel alloy	Secondary feedwater/ steam	Loss of material/ wastage and pitting corrosion	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D1-26 (R-51)	IV.D1.3-a	Upper assembly and separators Feedwater inlet ring and support	Steel	Secondary feedwater/ steam	Wall thinning/ flow-accelerated corrosion	A plant-specific aging management program is to be evaluated. Reference NRC IN 91-19, "Steam Generator Feedwater Distribution Piping Damage."	Yes, plant-specific

D2. STEAM GENERATOR (ONCE-THROUGH)

Systems, Structures, and Components

This section addresses the once-through type steam generators, as found in Babcock & Wilcox pressurized water reactors (PWRs), including all internal components and water/steam nozzles and safe ends. Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” the primary water side (tube side) of the steam generator is governed by Group A Quality Standards, and the secondary water side is governed by Group B Quality Standards.

Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in IV.E.

System Interfaces

The systems that interface with the steam generators include the reactor coolant system and connected lines (IV.C2), the main steam system (VIII.B1), the feedwater system (VIII.D1), the steam generator blowdown system (VIII.F), and the auxiliary feedwater system (VIII.G).

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
D2 Steam Generator (Once-Through)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.D2-1 (R-17)	IV.D2.1-j IV.D2.1-b	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No
IV.D2-2 (R-01)	IV.D2.1-h	Instrument penetrations and primary side nozzles, safe ends, and welds	Nickel alloy; steel with nickel-alloy cladding	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” for Class 1 components, and Chapter XI.M2, “Water Chemistry,” for PWR primary water and For nickel alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to submit a plant-specific AMP to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed
IV.D2-3 (R-222)	IV.D2.1-c	Once-through steam generator components: Primary side nozzles Safe ends and welds	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy	Reactor coolant	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation, and, for Class 1 components, environmental effects on fatigue are to be addressed. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA

IV D2	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM Steam Generator (Once-Through)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.D2-4 (R-35)	IV.D2.1-a	Primary side components Upper and lower heads Tube sheets and tube-to-tube sheet welds	Steel with stainless steel or nickel alloy cladding	Reactor coolant	Cracking/ stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 1 components, and Chapter XI.M2, "Water Chemistry," for PWR primary water and For nickel alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed
IV.D2-5 (R-31)	IV.D2.1-l	Secondary manways and handholes (cover only)	Steel	Air with leaking secondary-side water and/or steam	Loss of material/ erosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," for Class 2 components	No
IV.D2-6 (R-32)	IV.D2.1-k	Steam generator closure bolting	Steel	System temperature up to 340°C (644°F)	Loss of preload/ thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No

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IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
D2 Steam Generator (Once-Through)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.D2-7 (R-38)	IV.D2.1-f	Steam generator components feedwater and auxiliary feedwater nozzles and safe ends Steam nozzles and safe ends	Steel	Secondary feedwater/ steam	Wall thinning/ flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
IV.D2-8 (R-224)	IV.D2.1-e	Steam generator components Shell assembly	Steel	Secondary feedwater/ steam	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR secondary water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
IV.D2-9 (R-36)	IV.D2.1-i	Steam generator components Such as secondary side nozzles (vent, drain, and instrumentatio n)	Nickel alloy	Secondary feedwater/ steam	Cracking/ stress corrosion cracking	Chapter XI.M2, "Water Chemistry" and Chapter XI.M32 "One-Time Inspection" or Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
D2 Steam Generator (Once-Through)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.D2-10 (R-33)	IV.D2.1-g IV.D2.1-d	Steam generator components Top head; Steam nozzle and safe end; Upper and lower shell; FW and AFW nozzle and safe end; FW impingement plate and support	Steel	Secondary feedwater/ steam	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 “Metal Fatigue,” for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.D2-11 (R-42)	IV.D2.	Steam generator structural Tube support plates	Steel	Secondary feedwater/ steam	Ligament cracking/ corrosion	Chapter XI.M19, “Steam Generator Tubing Integrity” and Chapter XI.M2, “Water Chemistry,” for PWR secondary water	No
IV.D2-12 (R-40)	IV.D2.2-g IV.D2.2-f	Tube plugs	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M19, “Steam Generator Tubing Integrity” and Chapter XI.M2, “Water Chemistry,” for PWR primary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
D2 Steam Generator (Once-Through)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.D2-13 (R-226)	IV.D2.	Tubes	Nickel alloy	Secondary feedwater/ steam	Denting/ corrosion of carbon steel tube support plate	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water.	No
IV.D2-14 (R-44)	IV.D2.2-a	Tubes and sleeves	Nickel alloy	Reactor coolant	Cracking/ primary water stress corrosion cracking	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR primary water	No
IV.D2-15 (R-46)	IV.D2.2-e	Tubes and sleeves	Nickel alloy	Reactor coolant and secondary feedwater/steam	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
IV.D2-16 (R-48)	IV.D2.2-c	Tubes and sleeves	Nickel alloy	Secondary feedwater/ steam	Cracking/ intergranular attack	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No
IV.D2-17 (R-47)	IV.D2.2-b	Tubes and sleeves	Nickel alloy	Secondary feedwater/ steam	Cracking/ outer diameter stress corrosion cracking	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No

IV REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM
D2 Steam Generator (Once-Through)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
IV.D2-18 (R-49)	IV.D2.2-d	Tubes and sleeves	Nickel alloy	Secondary feedwater/ steam	Loss of material/ fretting and wear	Chapter XI.M19, "Steam Generator Tubing Integrity" and Chapter XI.M2, "Water Chemistry," for PWR secondary water	No

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E. COMMON MISCELLANEOUS MATERIAL/ENVIRONMENT COMBINATIONS

Systems, Structures, and Components

This section addresses the aging management programs for miscellaneous material/environment combinations which may be found throughout the reactor vessel, internals and reactor coolant system's structures and components. For the material/environment combinations in this part, aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation, therefore, no resulting aging management programs for these structures and components are required.

System Interfaces

The structures and components covered in this section belong to the engineered safety features in PWRs and BWRs. (For example, see System Interfaces in V.A to V.D2 for details.)

IV	REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM						
E	Common Miscellaneous Material Environment Combinations						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
IV.E-1 (RP-03)	IV.E.	Piping, piping components, and piping elements	Nickel alloy	Air – indoor uncontrolled (External)	None	None	No
IV.E-2 (RP-04)	IV.E.	Piping, piping components, and piping elements	Stainless steel	Air – indoor uncontrolled (External)	None	None	No
IV.E-3 (RP-05)	IV.E.	Piping, piping components, and piping elements	Stainless steel	Air with borated water leakage	None	None	No
IV.E-4 (RP-06)	IV.E.	Piping, piping components, and piping elements	Stainless steel	Concrete	None	None	No
IV.E-5 (RP-07)	IV.E.	Piping, piping components, and piping elements	Stainless steel	Gas	None	None	No
IV.E-6 (RP-01)	IV.E.	Piping, piping components, and piping elements	Steel	Concrete	None	None	No

CHAPTER V

ENGINEERED SAFETY FEATURES

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MAJOR PLANT SECTIONS

A. Containment Spray System (Pressurized Water Reactors)

B. Standby Gas Treatment System (Boiling Water Reactors)

C. Containment Isolation Components

D1. Emergency Core Cooling System (Pressurized Water Reactors)

D2. Emergency Core Cooling System (Boiling Water Reactors)

E. External Surfaces of Components and Miscellaneous Bolting

F. Common Miscellaneous Material/Environment Combinations

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A. CONTAINMENT SPRAY SYSTEM (PRESSURIZED WATER REACTORS)

Systems, Structures, and Components

This section addresses the containment spray system for pressurized water reactors (PWRs) designed to lower the pressure, temperature, and gaseous radioactivity (iodine) content of the containment atmosphere following a design basis event. Spray systems using chemically treated borated water are reviewed. The system consists of piping and valves, including containment isolation valves, flow elements, orifices, pumps, spray nozzles, eductors, and the containment spray system heat exchanger (for some plants).

Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” all components that comprise the containment spray system outside or inside the containment are governed by Group B Quality Standards.

Pumps and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or a specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in V.E. Common miscellaneous material/environment combinations, where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation, are included in V.F.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The systems that interface with the containment spray system are the PWR emergency core cooling (V.D1), and open- or closed-cycle cooling water systems (VII.C1 or VII.C2).

V	ENGINEERED SAFETY FEATURES						
A	Containment Spray System (PWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.A-1 (E-26)	V.A.5-a V.A.2-a	Ducting, piping and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.A-2 (EP-42)	V.A.	Encapsulation Components	Steel	Air – indoor uncontrolled (Internal)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
V.A-3 (EP-43)	V.A.	Encapsulation Components	Steel	Air with borated water leakage (Internal)	Loss of material/ general, pitting, crevice and boric acid corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
V.A-4 (E-28)	V.A.6-d V.A.4-b V.A.3-b V.A.1-b V.A.5-b	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
V.A-5 (EP-13)	V.A.	Heat exchanger components	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.A-6 (EP-37)	V.A.	Heat exchanger components	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.A-7 (E-19)	V.A.6-c	Heat exchanger components	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

V ENGINEERED SAFETY FEATURES
A Containment Spray System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.A-8 (E-20)	V.A.6-a	Heat exchanger components	Stainless steel	Raw water	Loss of material/ pitting, crevice, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
V.A-9 (E-17)	V.A.6-c	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.A-10 (E-18)	V.A.6-a	Heat exchanger components	Steel	Raw water	Loss of material/ general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
V.A-11 (EP-39)	V.A.	Heat exchanger tubes	Copper alloy	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.A-12 (EP-47)	V.A.	Heat exchanger tubes	Copper alloy	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

V ENGINEERED SAFETY FEATURES
A Containment Spray System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.A-13 (EP-35)	V.A.	Heat exchanger tubes	Stainless steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.A-14 (EP-50)	V.A.	Heat exchanger tubes	Stainless steel	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.A-15 (E-21)	V.A.6-b	Heat exchanger tubes	Stainless steel	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
V.A-16 (EP-34)	V.A.	Heat exchanger tubes	Stainless steel	Treated water	Reduction of heat transfer/ fouling	Chapter XI.M2, “Water Chemistry” The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.A-17 (EP-40)	V.A.	Heat exchanger tubes	Steel	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

V ENGINEERED SAFETY FEATURES
A Containment Spray System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.A-18 (E-43)	V.A.	Motor Cooler	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
V.A-19 (E-29)	V.A.2-a V.A.5-a	Piping and components internal surfaces	Steel	Air – indoor uncontrolled (Internal)	Loss of material/ general corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
V.A-20 (EP-36)	V.A.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.A-21 (EP-45)	V.A.	Piping, piping components, and piping elements	Copper alloy	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.A-22 (EP-27)	V.A.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
V.A-23 (EP-33)	V.A.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No

V ENGINEERED SAFETY FEATURES
A Containment Spray System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.A-24 (EP-44)	V.A.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.A-25 (EP-46)	V.A.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.A-26 (EP-53)	V.A.	Piping, piping components, piping elements internal surfaces, and tanks	Stainless steel	Condensation (Internal)	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
V.A-27 (EP-41)	V.A.	Piping, piping components, piping elements, and tanks	Stainless steel	Treated borated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” for PWR primary water	No
V.A-28 (E-12)	V.A.1-a V.A.3-a V.A.4-a V.A.1-c	Piping, piping components, piping elements, and tanks	Stainless steel	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” for PWR primary water	No

B. STANDBY GAS TREATMENT SYSTEM (BOILING WATER REACTORS)

Systems, Structures, and Components

This section addresses the standby gas treatment system found in boiling water reactors (BWRs) and consists of ductwork, filters, and fans. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the standby gas treatment system are governed by Group B Quality Standards.

Specifically, charcoal absorber filters are to be addressed consistent with the NRC position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of NEI, dated March 10, 2000. Components that function as system filters are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, from an aging management review (on a plant-specific basis), under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in V.E. Common miscellaneous material/environment combinations, where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation, are included in V.F.

System Interfaces

There are no system interfaces with the standby gas treatment system addressed in this section.

V ENGINEERED SAFETY FEATURES
B Standby Gas Treatment System (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.B-1 (E-25)	V.B.2-a	Ducting and components internal surfaces	Steel	Air – indoor uncontrolled (Internal)	Loss of material/ general corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
V.B-2 (E-40)	V.B.1-a	Ducting closure bolting	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.B-3 (E-26)	V.B.2-a V.B.1-a	Ducting, piping and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.B-4 (E-06)	V.B.2-b V.B.1-b	Elastomer seals and components	Elastomers	Air – indoor uncontrolled	Hardening and loss of strength/ elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
V.B-5 (EP-37)	V.B.	Heat exchanger components	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
V.B-6 (EP-36)	V.B.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.B-7 (EP-27)	V.B.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No

V ENGINEERED SAFETY FEATURES
B Standbv Gas Treatment System (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.B-8 (EP-54)	V.B.	Piping, piping components, and piping elements	Gray cast iron	Soil	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.B-9 (E-42)	V.B.	Piping, piping components, and piping elements	Steel (with or without coating or wrapping)	Soil	Loss of material/ general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M28, "Buried Piping and Tanks Surveillance," or Chapter XI.M34, "Buried Piping and Tanks Inspection"	No Yes, detection of aging effects and operating experience are to be further evaluated

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C. CONTAINMENT ISOLATION COMPONENTS

Systems, Structures, and Components

This section addresses the containment isolation components found in all designs of boiling water reactors (BWR) and pressurized water reactors (PWR) in the United States. The system consists of isolation barriers in lines for BWR and PWR nonsafety systems such as the plant heating, waste gas, plant drain, liquid waste, and cooling water systems. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the containment isolation components are governed by Group A or B Quality Standards.

The aging management programs for hatchways, hatch doors, penetration sleeves, penetration bellows, seals, gaskets, and anchors are addressed in II.A and II.B. The containment isolation valves for in-scope systems are addressed in the appropriate sections in IV, VII, and VIII.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in V.E. Common miscellaneous material/environment combinations, where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation, are included in V.F.

System Interfaces

There are no system interfaces with the containment isolation components addressed in this section.

V ENGINEERED SAFETY FEATURES C Containment Isolation Components							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.C-1 (E-35)	V.C.1-a	Containment isolation piping and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.C-2 (E-30)	V.C.1-a	Containment isolation piping and components external surfaces	Steel	Condensation (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.C-3 (E-34)	V.C.1-b	Containment isolation piping and components internal surfaces	Stainless steel	Raw water	Loss of material/ pitting, crevice, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
V.C-4 (E-33)	V.C.1-b	Containment isolation piping and components internal surfaces	Stainless steel	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry” The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

V ENGINEERED SAFETY FEATURES
C Containment Isolation Components

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.C-5 (E-22)	V.C.1-a	Containment isolation piping and components internal surfaces	Steel	Raw water	Loss of material/ general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
V.C-6 (E-31)	V.C.1-a	Containment isolation piping and components internal surfaces	Steel	Treated water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry" The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.C-7 (EP-33)	V.C.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.C-8 (EP-44)	V.C.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.C-9 (EP-48)	V.C.	Piping, piping components, and piping elements	Steel	Closed cycle cooling water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

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D1. EMERGENCY CORE COOLING SYSTEM (PRESSURIZED WATER REACTORS)

Systems, Structures, and Components

This section addresses the emergency core cooling systems for pressurized water reactors (PWRs) designed to cool the reactor core and provide safe shutdown following a design basis accident. They consist of the core flood system (CFS), residual heat removal (RHR) (or shutdown cooling (SDC)), high-pressure safety injection (HPSI), low-pressure safety injection (LPSI), and spent fuel pool (SFP) cooling systems, the lines to the chemical and volume control system (CVCS), the emergency sump, the HPSI and LPSI pumps, the pump seal coolers, the RHR heat exchanger, and the refueling water tank (RWT).

Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the emergency core cooling system are governed by Group B Quality Standards. Portions of the RHR, HPSI, and LPSI systems and the CVCS extending from the reactor coolant system up to and including the second containment isolation valve are governed by Group A Quality Standards and covered in IV.C2.

Pumps and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or a specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in V.E. Common miscellaneous material/environment combinations, where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation, are included in VI.F.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The systems that interface with the emergency core cooling system include the reactor coolant system and connected lines (IV.C2), the containment spray system (V.A), the spent fuel pool cooling and cleanup system (VII.A3), the closed-cycle cooling water system (VII.C2), the ultimate heat sink (VII.C3), the chemical and volume control system (VII.E1), and the open-cycle cooling water system (service water system) (VII.C1).

V ENGINEERED SAFETY FEATURES
D1 Emergency Core Cooling System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D1-1 (E-28)	V.D1.6-d V.D1.5-b V.D1.1-d V.D1.2-b V.D1.8-b V.D1.4-c V.D1.7-a V.D1.3-a	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
V.D1-2 (EP-13)	V.D1.	Heat exchanger components	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.D1-3 (EP-37)	V.D1.	Heat exchanger components	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.D1-4 (E-19)	V.D1.5-a V.D1.6-a	Heat exchanger components	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.D1-5 (E-20)	V.D1.6-b	Heat exchanger components	Stainless steel	Raw water	Loss of material/ pitting, crevice, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
V.D1-6 (E-17)	V.D1.6-a V.D1.5-a	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

V ENGINEERED SAFETY FEATURES
D1 Emergency Core Cooling System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D1-7 (E-18)	V.D1.6-b	Heat exchanger components	Steel	Raw water	Loss of material/ general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
V.D1-8 (EP-47)	V.D1.	Heat exchanger tubes	Copper alloy	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D1-19 (EP-35)	V.D1.	Heat exchanger tubes	Stainless steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.D1-10 (EP-50)	V.D1.	Heat exchanger tubes	Stainless steel	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

V ENGINEERED SAFETY FEATURES
D1 Emergency Core Cooling System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D1-11 (E-21)	V.D1.6-c	Heat exchanger tubes	Stainless steel	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
V.D1-12 (EP-40)	V.D1.	Heat exchanger tubes	Steel	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D1-13 (E-43)	V.D1.	Motor Cooler	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.D1-14 (E-24)	V.D1.2-c	Orifice (miniflow recirculation)	Stainless steel	Treated borated water	Loss of material/ erosion	A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. See Licensee Event Report 50-275/94-023 for evidence of erosion.	Yes, plant-specific
V.D1-15 (E-01)	V.D1.8-c	Partially encased tanks with breached moisture barrier	Stainless steel	Raw water	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottom because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes, plant-specific

V ENGINEERED SAFETY FEATURES
D1 Emergency Core Cooling System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D1-16 (E-47)	V.D1.1-b	Piping, piping components, and piping elements	Cast austenitic stainless steel	Treated borated water >250°C (>482°F)	Loss of fracture toughness/ thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
V.D1-17 (EP-36)	V.D1.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.D1-19 (EP-45)	V.D1.	Piping, piping components, and piping elements	Copper alloy	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D1-19 (EP-27)	V.D1.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.D1-20 (EP-52)	V.D1.	Piping, piping components, piping elements	Gray cast iron	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.D1-21 (EP-54)	V.D1.	Piping, piping components, and piping elements	Gray cast iron	Soil	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No

V ENGINEERED SAFETY FEATURES
D1 Emergency Core Cooling System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D1-22 (EP-33)	V.D1.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.D1-23 (EP-44)	V.D1.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.D1-24 (EP-51)	V.D1.	Piping, piping components, and piping elements	Stainless steel	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D1-25 (EP-55)	V.D1.	Piping, piping components, and piping elements	Stainless steel	Raw water	Loss of material/ pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
V.D1-26 (EP-31)	V.D1.	Piping, piping components, and piping elements	Stainless steel	Soil	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

V ENGINEERED SAFETY FEATURES
D1 Emergency Core Cooling System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D1-27 (E-13)	V.D1.1-c V.D1.4-a	Piping, piping components, and piping elements	Stainless steel	Treated borated water	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
V.D1-28 (EP-46)	V.D1.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D1-29 (EP-53)	V.D1.	Piping, piping components, piping elements internal surfaces, and tanks	Stainless steel	Condensation (Internal)	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
V.D1-30 (EP-41)	V.D1.	Piping, piping components, piping elements, and tanks	Stainless steel	Treated borated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No

V ENGINEERED SAFETY FEATURES D1 Emergency Core Cooling System (PWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.D1-31 (E-12)	V.D1.1-a V.D1.2-a V.D1.8-a V.D1.7-b V.D1.4-b	Piping, piping components, piping elements, and tanks	Stainless steel	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
V.D1-32 (EP-49)	V.D1.	Pump Casings	Steel with stainless steel cladding	Treated borated water	Loss of material/ cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	Yes, verify that plant-specific program addresses cladding breach
V.D1-33 (E-38)	V.D1.7-b	Safety injection tank (accumulator)	Steel with stainless steel cladding	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water	No

D2. EMERGENCY CORE COOLING SYSTEM (BOILING WATER REACTORS)

Systems, Structures, and Components

This section addresses the emergency core cooling systems for boiling water reactors (BWRs) designed to cool the reactor core and provide safe shutdown following a design basis accident. They consist of the high-pressure coolant injection (HPCI), reactor core isolation cooling (RCIC), high-pressure core spray (HPCS), automatic depressurization (ADS), low-pressure core spray (LPCS), low-pressure coolant injection (LPCI) and residual heat removal (RHR) systems, including various pumps and valves, the RHR heat exchangers, and the drywell and suppression chamber spray system (DSCSS). The auxiliary area ventilation system includes RCIC, HPCI, RHR, and core spray pump room cooling.

Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the emergency core cooling system outside the containment are governed by Group B Quality Standards and the portion of the DSCSS inside the containment up to the isolation valve is governed by Group A Quality Standards. Portions of the HPCI, RCIC, HPCS, LPCS, and LPCI (or RHR) systems extending from the reactor vessel up to and including the second containment isolation valve are governed by Group A Quality Standards and covered in IV.C1.

Pumps and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or a specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

The system piping includes all pipe sizes, including instrument piping.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in V.E. Common miscellaneous material/environment combinations, where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation, are included in VI.F.

System Interfaces

The systems that interface with the emergency core cooling system include the reactor vessel (IV.A1), the reactor coolant pressure boundary (IV.C1), the feedwater system (VIII.D2), the condensate system (VIII.E), the closed-cycle cooling water system (VII.C2), the open-cycle cooling water system (VII.C1), and the ultimate heat sink (VII.C3).

V ENGINEERED SAFETY FEATURES
D2 Emergency Core Cooling System (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D2-1 (E-04)	V.D2.5-b	Drywell and suppression chamber spray system (internal surfaces): Flow orifice Spray nozzles	Steel	Air – indoor uncontrolled (Internal)	Loss of material/ general corrosion and fouling	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
V.D2-2 (E-26)	V.D2.5-a V.D2.1-e	Ducting, piping and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.D2-3 (EP-13)	V.D2.	Heat exchanger components	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.D2-4 (EP-37)	V.D2.	Heat exchanger components	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
V.D2-5 (E-19)	V.D2.4-c	Heat exchanger components	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.D2-6 (E-20)	V.D2.4-a	Heat exchanger components	Stainless steel	Raw water	Loss of material/ pitting, crevice, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No

V ENGINEERED SAFETY FEATURES
D2 Emergency Core Cooling System (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.D2-7 (E-17)	V.D2.4-c	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
V.D2-8 (E-18)	V.D2.4-a	Heat exchanger components	Steel	Raw water	Loss of material/ general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
V.D2-9 (EP-47)	V.D2.	Heat exchanger tubes	Copper alloy	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-10 (EP-35)	V.D2.	Heat exchanger tubes	Stainless steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No

V ENGINEERED SAFETY FEATURES D2 Emergency Core Cooling System (BWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.D2-11 (EP-50)	V.D2.	Heat exchanger tubes	Stainless steel	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-12 (E-21)	V.D2.4-b	Heat exchanger tubes	Stainless steel	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
V.D2-13 (EP-34)	V.D2.	Heat exchanger tubes	Stainless steel	Treated water	Reduction of heat transfer/ fouling	Chapter XI.M2, “Water Chemistry” The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-14 (EP-40)	V.D2.	Heat exchanger tubes	Steel	Lubricating oil	Reduction of heat transfer/ fouling	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-15 (E-23)	V.D2.4-b	Heat exchanger tubes	Steel	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No

V D2	ENGINEERED SAFETY FEATURES Emergency Core Cooling System (BWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.D2-16 (E-29)	V.D2.5-a	Piping and components internal surfaces	Steel	Air – indoor uncontrolled (Internal)	Loss of material/ general corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
V.D2-17 (E-27)	V.D2.1-e	Piping and components internal surfaces	Steel	Condensation (Internal)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
V.D2-18 (EP-2)	V.D2.	Piping, piping components, and piping elements	Aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
V.D2-19 (EP-26)	V.D2.	Piping, piping components, and piping elements	Aluminum	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry" for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-20 (E-11)	V.D2.1-d	Piping, piping components, and piping elements	Cast austenitic stainless steel	Treated water >250°C (>482°F)	Loss of fracture toughness/ thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
V.D2-21 (EP-36)	V.D2.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

V ENGINEERED SAFETY FEATURES D2 Emergency Core Cooling System (BWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.D2-22 (EP-45)	V.D2.	Piping, piping components, and piping elements	Copper alloy	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-23 (EP-27)	V.D2.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.D2-24 (EP-54)	V.D2.	Piping, piping components, and piping elements	Gray cast iron	Soil	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
V.D2-25 (EP-33)	V.D2.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.D2-26 (EP-44)	V.D2.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
V.D2-27 (EP-31)	V.D2.	Piping, piping components, and piping elements	Stainless steel	Soil	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

V ENGINEERED SAFETY FEATURES D2 Emergency Core Cooling System (BWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.D2-28 (EP-32)	V.D2.	Piping, piping components, and piping elements	Stainless steel	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry" for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-29 (E-37)	V.D2.1-c V.D2.3-c	Piping, piping components, and piping elements	Stainless steel	Treated water >60°C (>140°F)	Cracking/ stress corrosion cracking and intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water	No
V.D2-30 (EP-46)	V.D2.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-31 (E-07)	V.D2.1-f	Piping, piping components, and piping elements	Steel	Steam	Wall thinning/ flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No

V D2	ENGINEERED SAFETY FEATURES Emergency Core Cooling System (BWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.D2-32 (E-10)	V.D2.1-b	Piping, piping components, and piping elements	Steel	Treated water	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
V.D2-33 (E-08)	V.D2.3-b V.D2.1-a V.D2.2-a	Piping, piping components, and piping elements	Steel	Treated water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V.D2-34 (E-09)	V.D2.3-a	Piping, piping components, and piping elements	Steel	Treated water	Wall thinning/ flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No
V.D2-35 (E-14)	V.D2.1-e	Piping, piping components, and piping elements internal surfaces	Stainless steel	Condensation (Internal)	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

E. EXTERNAL SURFACES OF COMPONENTS AND MISCELLANEOUS BOLTING

Systems, Structures, and Components

This section addresses the aging management programs for the degradation of external surfaces of all steel structures and components including closure boltings in the engineered safety features in pressurized water reactors (PWRs) and boiling water reactors (BWRs). For the steel components in PWRs, this section addresses only boric acid corrosion of external surfaces as a result of dripping borated water leaking from an adjacent PWR component. Boric acid corrosion can also occur for steel components containing borated water due to leakage, such components and the related aging management program are covered in the appropriate major plant sections in V.

System Interfaces

The structures and components covered in this section belong to the engineered safety features in PWRs and BWRs. (For example, see System Interfaces in V.A to V.D2 for details.)

V E	ENGINEERED SAFETY FEATURES External Surfaces of Components and Miscellaneous Bolting						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.E-1 (EP-1)	V.E.	Bolting	Steel	Air – outdoor (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No
V.E-2 (E-41)	V.E.	Bolting	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
V.E-3 (E-03)	V.E.2-b	Closure bolting	High-strength steel	Air with steam or water leakage	Cracking/ cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No
V.E-4 (EP-25)	V.E.	Closure bolting	Steel	Air – indoor uncontrolled (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No
V.E-5 (EP-24)	V.E.	Closure bolting	Steel	Air – indoor uncontrolled (External)	Loss of preload/ thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No
V.E-6 (E-02)	V.E.2-a	Closure bolting	Steel	Air with steam or water leakage	Loss of material/ general corrosion	Chapter XI.M18, "Bolting Integrity"	No
V.E-7 (E-44)	V.E.	External surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.E-8 (E-45)	V.E.	External surfaces	Steel	Air – outdoor (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.E-9 (E-28)	V.E.1-a	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No

V ENGINEERED SAFETY FEATURES
E External Surfaces of Components and Miscellaneous Bolting

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.E-10 (E-46)	V.E.1-b	External surfaces	Steel	Condensation (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
V.E-11 (EP-38)	V.E.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No

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F. COMMON MISCELLANEOUS MATERIAL/ENVIRONMENT COMBINATIONS

Systems, Structures, and Components

This section addresses the aging management programs for miscellaneous material/environment combinations which may be found throughout the emergency safety feature system's structures and components. For the material/environment combinations in this part, aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation, and therefore, no resulting aging management programs for these structures and components are required.

System Interfaces

The structures and components covered in this section belong to the engineered safety features in pressurized water reactors (PWRs) and boiling water reactors (BWRs). (For example, see System Interfaces in V.A to V.D2 for details.)

V ENGINEERED SAFETY FEATURES
F Common Miscellaneous Material/Environment Combinations

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.F-1 (EP-14)	V.F.	Ducting	Galvanized steel	Air – indoor controlled (External)	None	None	No
V.F-2 (EP-3)	V.F.	Piping, piping components, and piping elements	Aluminum	Air – indoor uncontrolled (Internal/External)	None	None	No
V.F-3 (EP-10)	V.F.	Piping, piping components, and piping elements	Copper alloy	Air – indoor uncontrolled (External)	None	None	No
V.F-4 (EP-9)	V.F.	Piping, piping components, and piping elements	Copper alloy	Gas	None	None	No
V.F-5 (EP-12)	V.F.	Piping, piping components, and piping elements	Copper alloy <15% Zn	Air with borated water leakage	None	None	No
V.F-6 (EP-15)	V.F.	Piping elements	Glass	Air – indoor uncontrolled (External)	None	None	No
V.F-7 (EP-16)	V.F.	Piping elements	Glass	Lubricating oil	None	None	No

V ENGINEERED SAFETY FEATURES
F Common Miscellaneous Material/Environment Combinations

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
V.F-8 (EP-28)	V.F.	Piping elements	Glass	Raw water	None	None	No
V.F-9 (EP-30)	V.F.	Piping elements	Glass	Treated borated water	None	None	No
V.F-10 (EP-29)	V.F.	Piping elements	Glass	Treated water	None	None	No
V.F-11 (EP-17)	V.F.	Piping, piping components, and piping elements	Nickel alloy	Air – indoor uncontrolled (External)	None	None	No
V.F-12 (EP-18)	V.F.	Piping, piping components, and piping elements	Stainless steel	Air – indoor uncontrolled (External)	None	None	No
V.F-13 (EP-19)	V.F.	Piping, piping components, and piping elements	Stainless steel	Air with borated water leakage	None	None	No
V.F-14 (EP-20)	V.F.	Piping, piping components, and piping elements	Stainless steel	Concrete	None	None	No

V	ENGINEERED SAFETY FEATURES						
F	Common Miscellaneous Material/Environment Combinations						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
V.F-15 (EP-22)	V.F.	Piping, piping components, and piping elements	Stainless steel	Gas	None	None	No
V.F-16 (EP-4)	V.F.	Piping, piping components, and piping elements	Steel	Air – indoor controlled (External)	None	None	No
V.F-17 (EP-5)	V.F.	Piping, piping components, and piping elements	Steel	Concrete	None	None	No
V.F-18 (EP-7)	V.F.	Piping, piping components, and piping elements	Steel	Gas	None	None	No

CHAPTER VI

ELECTRICAL COMPONENTS

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ELECTRICAL COMPONENTS

A. Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

B. Equipment Subject to 10 CFR 50.49 Environmental Qualification Requirements

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A. EQUIPMENT NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS

Systems, Structures and Components

This section addresses electrical cables and connections that are not subject to the environmental qualification requirements of 10 CFR 50.49, and that are installed in power and instrumentation and control (I&C) applications. The power cables and connections addressed are low-voltage (<1000V) and medium-voltage (2 kV to 35 kV). High voltage (>35 kV) power cables and connections have unique, specialized constructions and must be evaluated on an application specific basis.

This section also addresses components that are relied upon to meet the station blackout (SBO) requirements for restoration of offsite power. The plant system portion of the offsite power system that is used to connect the plant to the offsite power source is included in the SBO restoration equipment scope. This path typically includes the switchyard circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and transformer and onsite electrical distribution system (including bus ducts or cables), and associated control circuits and structures.

Electrical cables and their required terminations (i.e., connections) are typically reviewed as a single commodity. The types of connections included in this review are splices, mechanical connectors, fuse holders, and terminal blocks. This common review is translated into program actions, which treat cables and connections in the same manner.

Electrical cables and connections that are in the plant's environmental qualification (EQ) program are addressed in VI.B.

System Interfaces

Electrical cables and connections functionally interface with all plant systems that rely on electric power or instrumentation and control. Electrical cables and connections also interface with and are supported by structural commodities (e.g., cable trays, conduit, cable trenches, cable troughs, duct banks, cable vaults and manholes) that are reviewed, as appropriate, in the Structures and Components Supports section.

VI ELECTRICAL COMPONENTS A Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VI.A-1 (LP-12)	VI.A.	Cable Connections (Metallic Parts)	Various metals used for electrical contacts	Air – indoor and outdoor	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Chapter XI.E6, "Electrical Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No
VI.A-2 (L-01)	VI.A.1-a	Conductor insulation for electrical cables and connections	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/ degradation of organics (Thermal/ thermoxidative), radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation, and moisture intrusion	Chapter XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No

VI A	ELECTRICAL COMPONENTS Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VI.A-3 (L-02)	VI.A.1-b	Conductor insulation for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/ degradation of organics (Thermal/ thermoxidative), radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation, and moisture intrusion	Chapter XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits"	No
VI.A-4 (L-03)	VI.A.1-c	Conductor insulation for inaccessible medium-voltage (2kV to 35kV) cables (e.g., installed in conduit or direct buried)	Various organic polymers (e.g., EPR, SR, EPDM, XLPE)	Adverse localized environment caused by exposure to moisture and voltage	Localized damage and breakdown of insulation leading to electrical failure/ moisture intrusion, water trees	Chapter XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No

VI ELECTRICAL COMPONENTS A Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VI.A-5 (L-04)	VI.A.2-a	Connector contacts for electrical connectors exposed to borated water leakage	Various metals used for electrical contacts	Air with borated water leakage	Corrosion of connector contact surfaces/ intrusion of borated water	Chapter XI.M10, "Boric Acid Corrosion"	No
VI.A-6 (LP-03)	VI.A.	Fuse Holders (Not Part of a Larger Assembly); Insulation	Insulation material – bakelite, phenolic melamine or ceramic, molded polycarbonate and other	Adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen or > 60-year service limiting temperature	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/ degradation (Thermal/ thermoxidative) of organics/thermoplastics, radiation-induced oxidation, moisture intrusion and ohmic heating	Chapter XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No

VI ELECTRICAL COMPONENTS A Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VI.A-7 (LP-02)	VI.A.	Fuse Holders (Not Part of a Larger Assembly); Insulation	Insulation material – bakelite, phenolic melamine or ceramic, molded polycarbonate and other	Air – indoor uncontrolled (Internal/External)	None	None	No
VI.A-8 (LP-01)	VI.A.	Fuse Holders (Not Part of a Larger Assembly); Metallic Clamp	Copper alloy	Air – indoor	Fatigue/ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Chapter XI.E5, "Fuse Holders"	No
VI.A-9 (LP-07)	VI.A.	High voltage insulators	Porcelain, Malleable iron, aluminum, galvanized steel, cement	Air – outdoor	Degradation of insulator quality/presence of any salt deposits or surface contamination	A plant-specific aging management program is to be evaluated for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution).	Yes, plant-specific

VI ELECTRICAL COMPONENTS
A Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VI.A-10 (LP-11)	VI.A.	High voltage insulators	Porcelain, Malleable iron, aluminum, galvanized steel, cement	Air – outdoor	Loss of material/ mechanical wear due to wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VI.A-11 (LP-04)	VI.A.	Metal enclosed bus Bus/connections	Aluminum/ Silver Plated Aluminum Copper/ Silver Plated Copper; Stainless steel, steel	Air – indoor and outdoor	Loosening of bolted connections/ thermal cycling and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No
VI.A-12 (LP-10)	VI.A.	Metal enclosed bus Enclosure assemblies	Elastomers	Air – indoor and outdoor	Hardening and loss of strength/ elastomer degradation	Chapter XI.S6, "Structures Monitoring Program"	No
VI.A-13 (LP-06)	VI.A.	Metal enclosed bus Enclosure assemblies	Steel; galvanized steel	Air – indoor and outdoor	Loss of material/ general corrosion	Chapter XI.S6, "Structures Monitoring Program"	No

VI ELECTRICAL COMPONENTS
A Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VI.A-14 (LP-05)	VI.A.	Metal enclosed bus Insulation/insulators	Porcelain, xenoy, thermo-plastic organic polymers	Air – indoor and outdoor	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/ thermal/thermoxidative degradation of organics/thermoplastics, radiation-induced oxidation; moisture/debris intrusion, and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No
VI.A-15 (LP-09)	VI.A.	Switchyard bus and connections	Aluminum, copper, bronze, stainless steel, galvanized steel	Air – outdoor	Loss of material/ wind induced abrasion and fatigue Loss of conductor strength/ corrosion Increased resistance of connection/ oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

VI ELECTRICAL COMPONENTS
A Equipment Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VI.A-16 (LP-08)	VI.A.	Transmission conductors and connections	Aluminum, steel	Air – outdoor	Loss of material/ wind induced abrasion and fatigue Loss of conductor strength/ corrosion Increased resistance of connection/ oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

B. EQUIPMENT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS

Systems, Structures and Components

The Nuclear Regulatory Commission (NRC) has established nuclear station environmental qualification (EQ) requirements in 10 CFR Part 50 Appendix A, Criterion 4, and in 10 CFR 50.49. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments (i.e., those areas of the plant that could be subject to the harsh environmental effects of a loss of coolant accident [LOCA], high energy line breaks [HELBs] or post-LOCA radiation) are qualified to perform their safety function in those harsh environments after the effects of inservice aging. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification. Components in the EQ program have a qualified life, and the components are replaced at the end of that qualified life, if it is shorter than the current operating term. The qualified life may be extended by methods such as refurbishment or reanalysis, but the licensee is required by the EQ regulation (10 CFR 50.49) to replace the component when its qualified life has expired.

Similarly, some nuclear power plants have mechanical equipment that was qualified in accordance with the provisions of Criterion 4 of Appendix A to 10 CFR Part 50.

System Interfaces

Equipment subject to 10 CFR 50.49 environmental qualification requirements functionally interfaces with all plant systems that rely on electric power or instrumentation and control.

VI ELECTRICAL COMPONENTS
B Equipment Subject to 10 CFR 50.49 Environmental Qualification Requirements

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VI.B-1 (L-05)	VI.B.1-a	Electrical equipment subject to 10 CFR 50.49 EQ requirements	Various polymeric and metallic materials	Adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage	Various degradation/ various mechanisms	EQ is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.E1, “Environmental Qualification (EQ) of Electric Components,” of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes, TLAA

CHAPTER VII

AUXILIARY SYSTEMS

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MAJOR PLANT SECTIONS

A1. New Fuel Storage

A2. Spent Fuel Storage

A3. Spent Fuel Pool Cooling and Cleanup (PWR)

A4. Spent Fuel Pool Cooling and Cleanup (BWR)

A5. Suppression Pool Cleanup System (BWR)

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

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

C2. Closed-Cycle Cooling Water System

C3. Ultimate Heat Sink

D. Compressed Air System

E1. Chemical and Volume Control System (PWR)

E2. Standby Liquid Control System (BWR)

E3. Reactor Water Cleanup System (BWR)

E4. Shutdown Cooling System (Older BWR)

F1. Control Room Area Ventilation System

F2. Auxiliary and Radwaste Area Ventilation System

F3. Primary Containment Heating and Ventilation System

F4. Diesel Generator Building Ventilation System

G. Fire Protection

H1. Diesel Fuel Oil System

H2. Emergency Diesel Generator System

I. External Surfaces of Components and Miscellaneous Bolting

J. Common Miscellaneous Material/Environment Combinations

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A1. NEW FUEL STORAGE

Systems, Structures, and Components

This section discusses those structures and components used for new fuel storage which include carbon steel new fuel storage racks located in the auxiliary building or the fuel handling building. The racks are exposed to the temperature and humidity in the auxiliary building. The racks are generally painted with a protective coating. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components used for new fuel storage are governed by Group C Quality Standards.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

System Interfaces

No other systems discussed in this report interface with those used for new fuel storage.

VII AUXILIARY SYSTEMS
A1 New Fuel Storage

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.A1-1 (A-94)	VII.A1.1-a	Structural Steel	Steel	Air – indoor uncontrolled (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.S6, “Structures Monitoring Program”	No

A2. SPENT FUEL STORAGE

Systems, Structures, and Components

This section discusses those structures and components used for spent fuel storage and include stainless steel spent fuel storage racks and neutron absorbing materials (e.g., Boraflex, Boral, or boron-steel sheets, if used) submerged in chemically treated oxygenated boiling water reactor (BWR) or borated pressurized water reactor (PWR) water. The intended function of a 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 Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components used for spent fuel storage are governed by Group C Quality Standards. In some plants, the Boraflex has been replaced by Boral or boron steel.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

System Interfaces

No other systems discussed in this report interface with those used for spent fuel storage.

VII AUXILIARY SYSTEMS
A2 Spent Fuel Storage

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.A2-1 (AP-79)	VII.A2.	Piping, piping components, and piping elements	Stainless Steel; Steel with stainless steel cladding	Treated borated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
VII.A2-2 (A-87)	VII.A2.1-a	Spent fuel storage racks Neutron-absorbing sheets - BWR	Boraflex	Treated water	Reduction of neutron-absorbing capacity/ boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No
VII.A2-3 (A-89)	VII.A2.1-b	Spent fuel storage racks Neutron-absorbing sheets - BWR	Boral, boron steel	Treated water	Reduction of neutron-absorbing capacity and loss of material/ general corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.A2-4 (A-86)	VII.A2.1-a	Spent fuel storage racks Neutron-absorbing sheets - PWR	Boraflex	Treated borated water	Reduction of neutron-absorbing capacity/ boraflex degradation	Chapter XI.M22, "Boraflex Monitoring"	No

VII AUXILIARY SYSTEMS
A2 Spent Fuel Storage

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.A2-5 (A-88)	VII.A2.1-b	Spent fuel storage racks Neutron-absorbing sheets - PWR	Boral, boron steel	Treated borated water	Reduction of neutron-absorbing capacity and loss of material/ general corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.A2-6 (A-96)	VII.A2.1-c	Spent fuel storage racks Storage racks - BWR	Stainless steel	Treated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for BWR water	No
VII.A2-7 (A-97)	VII.A2.1-c	Spent fuel storage racks Storage racks - PWR	Stainless steel	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water	No

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A3. SPENT FUEL POOL COOLING AND CLEANUP (PRESSURIZED WATER REACTOR)

Systems, Structures, and Components

This section discusses the pressurized water reactor (PWR) spent fuel pool cooling and cleanup system and consists of piping, valves, heat exchangers, filters, linings, demineralizers, and pumps. The system contains borated water. The system removes heat from the spent fuel pool and transfers heat to the closed-cycle cooling water system, which in turn transfers heat to the open-cycle cooling water system. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the PWR spent fuel pool cooling and cleanup system are governed by Group C Quality Standards.

With respect to filters, these items are to be addressed consistent with the Nuclear Regulatory Commission (NRC) position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of the Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system filters are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS
A3 Spent Fuel Pool Cooling and Cleanup (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.A3-1 (A-15)	VII.A3.3-a VII.A3.2-d VII.A3.5-c VII.A3.5-a VII.A3.3-d VII.A3.2-a	Elastomer lining	Elastomers	Treated borated water	Hardening and loss of strength/ elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant-specific
VII.A3-2 (A-79)	VII.A3.1-a VII.A3.5-b VII.A3.3-c VII.A3.2-c VII.A3.2-b VII.A3.4-b VII.A3.6-a	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No
VII.A3-3 (A-63)	VII.A3.4-a	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No

VII AUXILIARY SYSTEMS
A3 Spent Fuel Pool Cooling and Cleanup (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.A3-4 (AP-1)	VII.A3.	Piping, piping components, and piping elements	Aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
VII.A3-5 (AP-12)	VII.A3.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.A3-6 (AP-43)	VII.A3.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.A3-7 (AP-31)	VII.A3.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.A3-8 (AP-79)	VII.A3.	Piping, piping components, and piping elements	Stainless Steel; Steel with stainless steel cladding	Treated borated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
VII.A3-9 (A-39)	VII.A3.5-a VII.A3.3-a VII.A3.2-a	Piping, piping components, and piping elements	Steel with elastomer lining	Treated borated water	Loss of material/ pitting and crevice corrosion (only for steel after lining degradation)	Chapter XI.M2, "Water Chemistry," for PWR primary water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS
A3 Spent Fuel Pool Cooling and Cleanup (PWR)

Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.A3-10 (A-56)	VII.A3.3-b	Piping, piping components, and piping elements	Steel with stainless steel cladding	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” for PWR primary water	No

A4. SPENT FUEL POOL COOLING AND CLEANUP (BOILING WATER REACTOR)

Systems, Structures, and Components

This section discusses the boiling water reactor (BWR) spent fuel pool cooling and cleanup system and consists of piping, valves, heat exchangers, filters, linings, demineralizers, and pumps. 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 Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the BWR spent fuel pool cooling and cleanup system are governed by Group C Quality Standards.

With respect to filters, these items are to be addressed consistent with the Nuclear Regulatory Commission (NRC) position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of the Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system filters are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS A4 Spent Fuel Pool Cooling and Cleanup (BWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.A4-1 (A-16)	VII.A4.5-b VII.A4.3-b VII.A4.3-a VII.A4.2-b VII.A4.5-a VII.A4.2-a	Elastomer lining	Elastomers	Treated water	Hardening and loss of strength/ elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated.	Yes, plant-specific
VII.A4-2 (A-70)	VII.A4.4-b	Heat exchanger components	Stainless steel; steel with stainless steel cladding	Treated water	Loss of material/ Pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.A4-3 (A-63)	VII.A4.4-a	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.A4-4 (AP-62)	VII.A4.	Heat exchanger tubes	Stainless steel	Treated water	Reduction of heat transfer/ fouling	Chapter XI.M2, "Water Chemistry" The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS A4 Spent Fuel Pool Cooling and Cleanup (BWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.A4-5 (AP-38)	VII.A4.	Piping, piping components, and piping elements	Aluminum	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry" The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.A4-6 (AP-12)	VII.A4.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.A4-7 (AP-64)	VII.A4.	Piping, piping components, and piping elements	Copper alloy	Treated water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.A4-8 (AP-43)	VII.A4.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.A4-9 (AP-32)	VII.A4.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.A4-10 (AP-31)	VII.A4.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No

VII AUXILIARY SYSTEMS
A4 Spent Fuel Pool Cooling and Cleanup (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.A4-11 (A-58)	VII.A4.1-a VII.A4.6-a	Piping, piping components, and piping elements	Stainless steel	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.A4-12 (A-40)	VII.A4.5-a VII.A4.2-a VII.A4.3-a	Piping, piping components, and piping elements	Steel with elastomer lining or stainless steel cladding	Treated water	Loss of material/ pitting and crevice corrosion (only for steel after lining/cladding degradation)	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

A5. SUPPRESSION POOL CLEANUP SYSTEM (BOILING WATER REACTOR)

Systems, Structures, and Components

This section discusses 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, valves, and pumps. These components are fabricated of carbon, low-alloy, or austenitic stainless steel. Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” the components that comprise the suppression pool cleanup system are governed by the same Group C Quality Standards Group as the corresponding components in the spent fuel pool cooling and cleanup system (VII.A4).

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

Evaluation Summary

There are no tables associated with this section because the suppression pool cleanup system in BWRs is similar to the spent fuel pool cooling and cleanup system (VII.A4), and the components in the two systems are identical or very similar. Therefore, the reader is referred to the section for the spent fuel storage pool system for a listing of aging effects, aging mechanisms, and aging management programs that are to be applied to the suppression pool cleanup system components. (The only component in VII.A4 that may not be applicable to the suppression pool cleanup system is the heat exchanger [VII.A4.4].)

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B. OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS

Systems, Structures, and Components

Most commercial nuclear facilities have between fifty and one hundred cranes. Many of these cranes are industrial grade cranes that must meet the requirements of 29 CFR Volume XVII, Part 1910, and Section 1910.179. They do not fall within the scope of 10 CFR Part 54.4 and therefore are not required to be part of the integrated plant assessment (IPA). Normally fewer than ten cranes fall within the scope of 10 CFR Part 54.4. These cranes must comply with the requirements provided in 10 CFR Part 50.65 and Reg. Guide 1.160 for monitoring the effectiveness of maintenance at nuclear power plants.

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (the Program) must demonstrate that the testing and the monitoring of the maintenance programs have been completed to ensure that the structures, systems, and components of these cranes are capable of sustaining their rated loads during the period of extended operation. The inspection is also to evaluate whether the usage of the cranes or hoists has been sufficient to warrant additional fatigue analysis. It should be noted that many of the systems and components of these cranes can be classified as moving parts or as components which change configuration, or they may be subject to replacement based on a qualified life. In any of these cases, they will not fall within the scope of this Aging Management Review (AMR). The primary components that this program is concerned with are the structural girders and beams that make up the bridge and the trolley.

Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” all components that comprise the overhead heavy load and light load handling systems are governed by Group C Quality Standards.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

System Interfaces

No other systems discussed in this report interface with the overhead heavy load and light load (related to refueling) handling systems. Physical interfaces exist with the supporting structure. The direct interface is at the connection to the structure.

VII	AUXILIARY SYSTEMS						
B	Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.B-1 (A-05)	VII.B.2-a	Cranes - rails	Steel	Air – indoor uncontrolled (External)	Loss of material/ wear	Chapter XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems”	No
VII.B-2 (A-06)	VII.B.1-a	Cranes - Structural girders	Steel	Air – indoor uncontrolled (External)	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54. See the Standard Review Plan, Section 4.7, “Other Plant-Specific Time-Limited Aging Analyses,” for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
VII.B-3 (A-07)	VII.B.1-b	Cranes - Structural girders	Steel	Air – indoor uncontrolled (External)	Loss of material/ General corrosion	Chapter XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems”	No

C1. OPEN-CYCLE COOLING WATER SYSTEM (SERVICE WATER SYSTEM)

Systems, Structures, and Components

This section discusses the open-cycle cooling water (OCCW) (or service water) system, which consists of piping, heat exchangers, pumps, flow orifices, basket strainers, and valves, including containment isolation valves. Because the characteristics of an 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 lake, ocean, river, spray pond, or cooling tower. The AMPs described in this section apply to any such system, provided the service conditions and materials of construction are identical to those identified in the section. 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 addressed in this section 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 those for the steam turbine bearing oil coolers (VIII.A) and for the condensate system coolers (VIII.E).

Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the open-cycle cooling water system are governed by Group C Quality Standards, with the exception of those forming part of the containment penetration boundary which are governed by Group B Quality Standards.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS C1 Open-Cycle Cooling Water System (Service Water System)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.C1-1 (AP-75)	VII.C1.	Elastomer seals and components	Elastomers	Raw water	Hardening and loss of strength/ elastomer degradation	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
VII.C1-2 (AP-76)	VII.C1.	Elastomer seals and components	Elastomers	Raw water	Loss of material/ erosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
VII.C1-3 (A-65)	VII.C1.3-a	Heat exchanger components	Copper alloy	Raw water	Loss of material/ pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
VII.C1-4 (A-66)	VII.C1.3-a	Heat exchanger components	Copper alloy >15% Zn	Raw water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.C1-5 (A-64)	VII.C1.3-a	Heat exchanger components	Steel	Raw water	Loss of material/ general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
VII.C1-6 (A-72)	VII.C1.3-b	Heat exchanger tubes	Copper alloy	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
VII.C1-7 (AP-61)	VII.C1.	Heat exchanger tubes	Stainless steel	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No

VII AUXILIARY SYSTEMS
C1 Open-Cycle Cooling Water System (Service Water System)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.C1-8 (AP-47)	VII.C1.	Piping, piping components, and piping elements	Copper alloy	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.C1-9 (A-44)	VII.C1.2-a VII.C1.1-a	Piping, piping components, and piping elements	Copper alloy	Raw water	Loss of material/ pitting, crevice, and microbiologically influenced corrosion, and fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
VII.C1-10 (A-47)	VII.C1.1-a VII.C1.2-a	Piping, piping components, and piping elements	Copper alloy >15% Zn	Raw water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.C1-11 (A-51)	VII.C1.5-a	Piping, piping components, and piping elements	Gray cast iron	Raw water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.C1-12 (A-02)	VII.C1.1-c	Piping, piping components, and piping elements	Gray cast iron	Soil	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials"	No
VII.C1-13 (AP-53)	VII.C1.	Piping, piping components, and piping elements	Nickel alloy	Raw water	Loss of material/ pitting and crevice corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No

VII AUXILIARY SYSTEMS
C1 Open-Cycle Cooling Water System (Service Water System)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.C1-14 (AP-59)	VII.C1.	Piping, piping components, and piping elements	Stainless steel	Lubricating oil	Loss of material/ pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.C1-15 (A-54)	VII.C1.2-a VII.C1.6-a VII.C1.1-a VII.C1.4-a	Piping, piping components, and piping elements	Stainless steel	Raw water	Loss of material/ pitting and crevice corrosion, and fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No
VII.C1-16 (AP-56)	VII.C1.	Piping, piping components, and piping elements	Stainless steel	Soil	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.C1-17 (AP-30)	VII.C1.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS C1 Open-Cycle Cooling Water System (Service Water System)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.C1-18 (A-01)	VII.C1.1-b	Piping, piping components, and piping elements	Steel (with or without coating or wrapping)	Soil	Loss of material/ general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M28, “Buried Piping and Tanks Surveillance,” or Chapter XI.M34, “Buried Piping and Tanks Inspection”	No Yes, detection of aging effects and operating experience are to be further evaluated
VII.C1-19 (A-38)	VII.C1.6-a VII.C1.2-a VII.C1.1-a VII.C1.5-a	Piping, piping components, and piping elements	Steel (with or without lining/coating or with degraded lining/coating)	Raw water	Loss of material/ general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining/coating degradation	Chapter XI.M20, “Open-Cycle Cooling Water System”	No

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C2. CLOSED-CYCLE COOLING WATER SYSTEM

Systems, Structures, and Components

This section discusses the closed-cycle cooling water (CCCW) system, which consists of piping, radiation elements, temperature elements, heat exchangers, pumps, tanks, flow orifices, and valves, including 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 the chemical and volume control system and the spent fuel cooling system to the open-cycle cooling water system (VII.C1). A CCCW system is defined as part of the service water system that does not reject heat directly to a heat sink, has water chemistry control, and is not subject to significant sources of contamination.

Based on RG 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, with the exception of those forming part of the containment penetration boundary which are Group B.

The aging management programs (AMPs) for the heat exchanger between the closed-cycle and the open-cycle cooling water systems are addressed in the open-cycle cooling water system (VII.C1). The AMPs for the heat exchangers between the closed-cycle cooling water system and the interfacing auxiliary systems are included in the evaluations of their respective systems, such as those for the pressurized water reactor (PWR) and boiling water reactor (BWR) spent fuel pool cooling and cleanup systems (VII.A3 and VII.A4, respectively) and the chemical and volume control system (VII.E1).

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The systems that interface with the closed-cycle cooling water system include the open-cycle cooling water system (VII.C1), the PWR spent fuel pool cooling and cleanup system (VII.A3), the BWR spent fuel pool cooling and cleanup system (VII.A4), the chemical and volume control system (VII.E1), the BWR reactor water cleanup system (VII.E3), the shutdown cooling system (older BWR, VII.E4), the primary containment heating and ventilation system (VII.F3), fire protection (VII.G), the emergency diesel generator system (VII.H2), the PWR containment spray system (V.A), the PWR and BWR emergency core cooling systems (V.D1 and V.D2), the PWR steam generator blowdown system (VIII.F), the condensate system (VIII.E), and the PWR auxiliary feedwater system (VIII.G).

VII AUXILIARY SYSTEMS
C2 Closed-Cycle Cooling Water System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.C2-1 (A-63)	VII.C2.	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.C2-2 (AP-80)	VII.C2.	Heat exchanger tubes	Copper Alloy	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.C2-3 (AP-63)	VII.C2.	Heat exchanger tubes	Stainless steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.C2-4 (AP-12)	VII.C2.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.C2-5 (AP-47)	VII.C2.	Piping, piping components, and piping elements	Copper alloy	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.C2-6 (AP-43)	VII.C2.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.C2-7 (AP-32)	VII.C2.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No

VII AUXILIARY SYSTEMS
C2 Closed-Cycle Cooling Water System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.C2-8 (A-50)	VII.C2.3-a	Piping, piping components, and piping elements	Gray cast iron	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.C2-9 (AP-31)	VII.C2.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.C2-10 (A-52)	VII.C2.2-a	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water	Loss of material/ pitting and crevice corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.C2-11 (AP-60)	VII.C2.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.C2-12 (AP-59)	VII.C2.	Piping, piping components, and piping elements	Stainless steel	Lubricating oil	Loss of material/ pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS
C2 Closed-Cycle Cooling Water System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.C2-13 (AP-30)	VII.C2.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.C2-14 (A-25)	VII.C2.3-a VII.C2.2-a VII.C2.5-a VII.C2.4-a VII.C2.1-a	Piping, piping components, piping elements, and tanks	Steel	Closed cycle cooling water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

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C3. ULTIMATE HEAT SINK

Systems, Structures, and Components

The ultimate heat sink (UHS) consists of a lake, ocean, river, spray pond, or cooling tower. The UHS 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 section consist of piping, valves, and pumps. The cooling tower is addressed in this report on water-control structures (III.A6). The ultimate heat sink absorbs heat from the residual heat removal system or other similar system. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," the piping and valves used for the ultimate heat sink are governed by Group C Quality Standards.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS
C3 Ultimate Heat Sink

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.C3-1 (AP-61)	VII.C3.	Heat exchanger tubes	Stainless steel	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
VII.C3-2 (A-43)	VII.C3.1-a VII.C3.2-a	Piping, piping components, and piping elements	Copper alloy	Raw water	Loss of material/ pitting and crevice corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
VII.C3-3 (A-47)	VII.C3.2-a VII.C3.1-a	Piping, piping components, and piping elements	Copper alloy >15% Zn	Raw water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.C3-4 (A-51)	VII.C3.	Piping, piping components, and piping elements	Gray cast iron	Raw water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.C3-5 (A-02)	VII.C3.	Piping, piping components, and piping elements	Gray cast iron	Soil	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials"	No
VII.C3-6 (AP-53)	VII.C3.	Piping, piping components, and piping elements	Nickel alloy	Raw water	Loss of material/ pitting and crevice corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
VII.C3-7 (A-53)	VII.C3.2-a	Piping, piping components, and piping elements	Stainless steel	Raw water	Loss of material/ pitting and crevice corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No

VII AUXILIARY SYSTEMS C3 Ultimate Heat Sink							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.C3-8 (AP-56)	VII.C3.	Piping, piping components, and piping elements	Stainless steel	Soil	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.C3-9 (A-01)	VII.C3.	Piping, piping components, and piping elements	Steel (with or without coating or wrapping)	Soil	Loss of material/ general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M28, “Buried Piping and Tanks Surveillance,” or Chapter XI.M34, “Buried Piping and Tanks Inspection”	No Yes, detection of aging effects and operating experience are to be further evaluated
VII.C3-10 (A-38)	VII.C3.1-a VII.C3.2-a VII.C3.3-a	Piping, piping components, and piping elements	Steel (with or without lining/coating or with degraded lining/coating)	Raw water	Loss of material/ general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining/coating degradation	Chapter XI.M20, “Open-Cycle Cooling Water System”	No

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D. COMPRESSED AIR SYSTEM

Systems, Structures, and Components

This section discusses the compressed air system, which consists of piping, valves (including containment isolation valves), air receiver, pressure regulators, filters, and dryers. The system components and piping are located in various buildings at most nuclear power plants. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components of the compressed air system are classified as Group D Quality Standards, with the exception of those forming part of the containment penetration boundary which are Group B. However, the cleanliness of these components and high air quality is to be maintained because the air provides the motive power for instruments and active components (some of them safety-related) that may not function properly if nonsafety Group D equipment is contaminated.

With respect to filters, these items are to be addressed consistent with the Nuclear Regulatory Commission (NRC) position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system filters are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS D Compressed Air System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.D-1 (A-103)	VII.D.2-a	Closure bolting	Steel	Condensation	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No
VII.D-2 (A-26)	VII.D.5-a VII.D.6-a VII.D.3-a VII.D.2-a VII.D.4-a VII.D.1-a	Compressed air system Piping, piping components, and piping elements	Steel	Condensation (Internal)	Loss of material/ general and pitting corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No
VII.D-3 (A-80)	VII.D.3-a VII.D.5-a VII.D.6-a VII.D.4-a VII.D.2-a VII.D.1-a	Piping and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.D-4 (AP-81)	VII.D.	Piping, piping components, and piping elements	Stainless steel	Condensation (Internal)	Loss of material/ pitting and crevice corrosion	Chapter XI.M24, "Compressed Air Monitoring"	No

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (PRESSURIZED WATER REACTOR)

Systems, Structures, and Components

This section discusses a portion of the pressurized water reactor (PWR) chemical and volume control system (CVCS). The portion of the PWR CVCS covered in this section extends from the isolation valves associated with the reactor coolant pressure boundary (and Code change as discussed below) to the volume control tank. This portion of the PWR CVCS consists of high- and low-pressure piping and valves (including the containment isolation valves), regenerative and letdown heat exchangers, pumps, basket strainers, and the 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).

Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” all components that comprise the CVCS are governed by 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 governed by Group A Quality Standards and covered in IV.C2.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS E1 Chemical and Volume Control System (PWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E1-1 (A-79)	VII.E1.9-a VII.E1.3-b VII.E1.10-a VII.E1.5-b VII.E1.7-b VII.E1.6-a VII.E1.1-b VII.E1.4-a VII.E1.2-a VII.E1.8-d	External surfaces	Steel	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No
VII.E1-2 (AP-34)	VII.E1.	Heat exchanger components	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.E1-3 (AP-65)	VII.E1.	Heat exchanger components	Copper alloy >15% Zn	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No

VII AUXILIARY SYSTEMS
E1 Chemical and Volume Control System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.E1-4 (A-100)	VII.E1.8-a	Heat exchanger components	Stainless steel	Treated borated water	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
VII.E1-5 (A-84)	VII.E1.7-c	Heat exchanger components	Stainless steel	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking, cyclic loading	Chapter XI.M2, "Water Chemistry," for PWR primary water The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. A plant specific aging management program is to be evaluated.	Yes, plant-specific
VII.E1-6 (A-63)	VII.E1.8-c	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E1-7 (A-76)	VII.E1.5-a	High-pressure pump Casing	Stainless steel	Treated borated water	Cracking/ stress corrosion cracking, cyclic loading	Chapter XI.M2, "Water Chemistry," for PWR primary water The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. A plant specific aging management program is to be evaluated.	Yes, plant-specific

VII AUXILIARY SYSTEMS E1 Chemical and Volume Control System (PWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E1-8 (A-104)	VII.E1.5-a	High-pressure pump Closure bolting	High-strength steel	Air with steam or water leakage	Cracking/ cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity." The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes, if the bolts are not replaced during maintenance
VII.E1-9 (A-69)	VII.E1.8-b	Non-regenerative heat exchanger components	Stainless steel	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking, cyclic loading	Chapter XI.M2, "Water Chemistry," for PWR primary water. The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading, or loss of material due to pitting and crevice corrosion. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes, plant-specific
VII.E1-10 (AP-1)	VII.E1.	Piping, piping components, and piping elements	Aluminum	Air with borated water leakage	Loss of material/ boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
VII.E1-11 (AP-12)	VII.E1.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

VII AUXILIARY SYSTEMS E1 Chemical and Volume Control System (PWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E1-12 (AP-47)	VII.E1.	Piping, piping components, and piping elements	Copper alloy	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E1-13 (AP-43)	VII.C2.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.E1-14 (AP-31)	VII.E1.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.E1-15 (AP-59)	VII.E1.	Piping, piping components, and piping elements	Stainless steel	Lubricating oil	Loss of material/ pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS
E1 Chemical and Volume Control System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.E1-16 (A-57)	VII.E1.1-a VII.E1.8-a VII.E1.7-a VII.E1.3-a	Piping, piping components, and piping elements	Stainless steel	Treated borated water	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
VII.E1-17 (AP-79)	VII.E1.	Piping, piping components, and piping elements	Stainless Steel; Steel with stainless steel cladding	Treated borated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
VII.E1-18 (A-34)	VII.E1.1-a VII.E1.8-a VII.E1.7-a VII.E1.3-a	Piping, piping components, and piping elements	Steel	Air – indoor uncontrolled	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
VII.E1-19 (AP-30)	VII.E1.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS
E1 Chemical and Volume Control System (PWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.E1-20 (AP-82)	VII.E1.	Piping, piping components, piping elements, and tanks	Stainless steel	Treated borated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water	No
VII.E1-21 (AP-85)	VII.E1.	Pump Casings	Steel with stainless steel cladding	Treated borated water	Loss of material/ cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	Yes, verify plant-specific program addresses cladding breach

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E2. STANDBY LIQUID CONTROL SYSTEM (BOILING WATER REACTOR)

Systems, Structures, and Components

This section discusses the portion of 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, the solution storage tank, the 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.

Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” all components that comprise the standby liquid control system are governed by 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 governed by Group A Quality Standards and are covered in IV.C1.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The system that interfaces with the SLC system is the BWR reactor pressure vessel (IV.A1). If used, the SLC system would inject sodium pentaborate solution into the pressure vessel near the bottom of the reactor core.

VII AUXILIARY SYSTEMS
E2 Standby Liquid Control System (BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.E2-1 (AP-73)	VII.E2.	Piping, piping components, and piping elements	Stainless steel	Sodium pentaborate solution	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E2-2 (A-59)	VII.E2.4-a VII.E2.1-a VII.E2.2-a VII.E2.3-a	Piping, piping components, and piping elements	Stainless steel	Sodium pentaborate solution >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

E3. REACTOR WATER CLEANUP SYSTEM (BOILING WATER REACTOR)

Systems, Structures, and Components

This section discusses the reactor water cleanup (RWCU) system, which provides for cleanup and particulate removal from the recirculating reactor coolant in all boiling water reactors (BWRs). Some plants may not include the RWCU system in the scope of license renewal, while other plants may include the RWCU system because it is associated with safety-related functions.

Based on 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 for are covered in IV.C1. The remainder of the system outboard of the isolation valves is governed by Group C Quality Standards. In this table, only aging management programs for RWCU-related piping and components outboard of the isolation valves are evaluated. The aging management program for containment isolation valves in the RWCU system is evaluated in IV.C1, which concerns the reactor coolant pressure boundary in BWRs.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS
E3 Reactor Water Cleanup System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.E3-1 (A-67)	VII.E3.4-b	Heat exchanger components	Stainless steel; steel with stainless steel cladding	Closed cycle cooling water	Loss of material/ microbiologically influenced corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E3-2 (A-68)	VII.E3.4-a	Heat exchanger components	Stainless steel; steel with stainless steel cladding	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E3-3 (A-71)	VII.E3.4-a	Heat exchanger components	Stainless steel; steel with stainless steel cladding	Treated water >60°C (>140°F)	Cracking/ stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.E3-4 (A-63)	VII.E3.	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E3-5 (AP-63)	VII.E3.	Heat exchanger tubes	Stainless steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

VII AUXILIARY SYSTEMS E3 Reactor Water Cleanup System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E3-6 (AP-62)	VII.E3.	Heat exchanger tubes	Stainless steel	Treated water	Reduction of heat transfer/ fouling	Chapter XI.M2, “Water Chemistry” The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E3-7 (AP-38)	VII.E3.	Piping, piping components, and piping elements	Aluminum	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry" The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E3-8 (AP-12)	VII.E3.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.E3-9 (AP-64)	VII.E3.	Piping, piping components, and piping elements	Copper alloy	Treated water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E3-10 (AP-43)	VII.E3.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No

VII AUXILIARY SYSTEMS E3 Reactor Water Cleanup System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E3-11 (AP-32)	VII.E3.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.E3-12 (AP-31)	VII.E3.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.E3-13 (AP-60)	VII.E3.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E3-14 (A-62)	VII.E3.1-b VII.E3.2-b	Piping, piping components, and piping elements	Stainless steel	Treated water	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
VII.E3-15 (A-58)	VII.E3.	Piping, piping components, and piping elements	Stainless steel	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS E3 Reactor Water Cleanup System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E3-16 (A-60)	VII.E3.1-a VII.E3.2-a	Piping, piping components, and piping elements	Stainless steel	Treated water >60°C (>140°F)	Cracking/ stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M25, "BWR Reactor Water Cleanup System"	No
VII.E3-17 (A-34)	VII.E3.2-c	Piping, piping components, and piping elements	Steel	Air – indoor uncontrolled	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
VII.E3-18 (A-35)	VII.E3.	Piping, piping components, and piping elements	Steel	Treated water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E3-19 (A-85)	VII.E3.3-d	Regenerative heat exchanger components	Stainless steel	Treated water >60°C (>140°F)	Cracking/ stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

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E4. SHUTDOWN COOLING SYSTEM (OLDER BWR)

Systems, Structures, and Components

This section discusses the shutdown cooling (SDC) system for older vintage boiling water reactors (BWRs) and consists of piping and fittings, the SDC system pump, the heat exchanger, and valves.

Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the SDC system are governed by Group B Quality Standards. Portions of the SDC system extending from the reactor coolant pressure boundary up to and including the containment isolation valves are governed by Group A Quality Standards and are covered in IV.C1.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII E4	AUXILIARY SYSTEMS Shutdown Cooling System (Older BWR)						
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E4-1 (A-67)	VII.E4.4-a	Heat exchanger components	Stainless steel; steel with stainless steel cladding	Closed cycle cooling water	Loss of material/ microbiologically influenced corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E4-2 (A-63)	VII.E4.4-a	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E4-3 (AP-63)	VII.E4.	Heat exchanger tubes	Stainless steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E4-4 (AP-38)	VII.E4.	Piping, piping components, and piping elements	Aluminum	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry" The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E4-5 (AP-12)	VII.E4.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

VII AUXILIARY SYSTEMS E4 Shutdown Cooling System (Older BWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E4-6 (AP-47)	VII.E4.	Piping, piping components, and piping elements	Copper alloy	Lubricating oil	Loss of material/ pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E4-7 (AP-64)	VII.E4.	Piping, piping components, and piping elements	Copper alloy	Treated water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M2, “Water Chemistry,” for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E4-8 (AP-43)	VII.E4.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.E4-9 (AP-32)	VII.E4.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.E4-10 (AP-31)	VII.E4.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No

VII AUXILIARY SYSTEMS
E4 Shutdown Cooling System (Older BWR)

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.E4-11 (AP-60)	VII.E4.	Piping, piping components, and piping elements	Stainless steel	Closed cycle cooling water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.E4-12 (AP-59)	VII.E4.	Piping, piping components, and piping elements	Stainless steel	Lubricating oil	Loss of material/ pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E4-13 (A-62)	VII.E4.1-b	Piping, piping components, and piping elements	Stainless steel	Treated water	Cumulative fatigue damage/ fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA
VII.E4-14 (A-58)	VII.E4.1-a	Piping, piping components, and piping elements	Stainless steel	Treated water	Loss of material/ pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

VII AUXILIARY SYSTEMS E4 Shutdown Cooling System (Older BWR)							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.E4-15 (A-61)	VII.E4.3-a VII.E4.1-c	Piping, piping components, and piping elements	Stainless steel	Treated water >60°C (>140°F)	Cracking/ stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry," for BWR water	No
VII.E4-16 (AP-30)	VII.E4.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.E4-17 (A-35)	VII.E4.1-a VII.E4.2-a	Piping, piping components, and piping elements	Steel	Treated water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated

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F1. CONTROL ROOM AREA VENTILATION SYSTEM

Systems, Structures, and Components

This section discusses the control room area ventilation system (with warm moist air as the normal environment), which contains ducts, piping and fittings, equipment frames and housings, flexible collars and seals, filters, and heating and cooling air handlers. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the control room area ventilation system are governed by Group B Quality Standards.

With respect to filters and seals, these items are to be addressed consistent with the Nuclear Regulatory Commission (NRC) position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system filters and seals are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The system that interfaces with the control room area ventilation system is the auxiliary and radwaste area ventilation system (VII.F2). The cooling coils receive their cooling water from other systems, such as the hot water heating system or the chilled water cooling system.

VII AUXILIARY SYSTEMS
F1 Control Room Area Ventilation System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.F1-1 (A-09)	VII.F1.4-a	Ducting and components	Stainless steel	Condensation	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F1-2 (A-10)	VII.F1.4-a VII.F1.1-a	Ducting and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F1-3 (A-08)	VII.F1.4-a VII.F1.1-a	Ducting and components internal surfaces	Steel	Condensation (Internal)	Loss of material/ general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
VII.F1-4 (A-105)	VII.F1.1-a	Ducting closure bolting	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F1-5 (A-73)	VII.F1.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (External)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F1-6 (A-18)	VII.F1.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F1-7 (A-17)	VII.F1.4-b VII.F1.1-b	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal/ External)	Hardening and loss of strength/ elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F1-8 (AP-34)	VII.F1.	Heat exchanger components	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No

VII AUXILIARY SYSTEMS F1 Control Room Area Ventilation System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.F1-9 (AP-65)	VII.F1.	Heat exchanger components	Copper alloy >15% Zn	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.F1-10 (AP-41)	VII.F1.	Heat exchanger components	Steel	Air – indoor uncontrolled (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F1-11 (A-63)	VII.F1.	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F1-12 (AP-80)	VII.F1.	Heat exchanger tubes	Copper Alloy	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F1-13 (AP-77)	VII.F1.	Heat exchanger tubes	Steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F1-14 (AP-74)	VII.F1.	Piping, piping components, and piping elements	Aluminum	Condensation	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F1-15 (AP-12)	VII.F1.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F1-16 (A-46)	VII.F1.2-a	Piping, piping components, and piping elements	Copper alloy	Condensation (External)	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

VII AUXILIARY SYSTEMS F1 Control Room Area Ventilation System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.F1-17 (AP-43)	VII.F1.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.F1-18 (AP-31)	VII.F1.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.F1-19 (AP-30)	VII.F1.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, “One-Time Inspection,” for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.F1-20 (A-25)	VII.F1.3-a	Piping, piping components, piping elements, and tanks	Steel	Closed cycle cooling water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No

F2. Auxiliary and Radwaste Area Ventilation System

Systems, Structures, and Components

This section discusses the auxiliary and radwaste areas ventilation systems (with warm moist air as the normal environment) and contains ducts, piping and fittings, equipment frames and housings, flexible collars and seals, filters, and heating and cooling air handlers. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the auxiliary and radwaste area ventilation system are governed by Group B Quality Standards.

With respect to filters and seals, these items are to be addressed consistent with the NRC position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system filters and seals are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The systems that interface with the auxiliary and radwaste area ventilation system are the control room area ventilation system (VII.F1) and the diesel generator building ventilation system (VII.F4). The cooling coils receive their cooling water from other systems, such as the hot water heating system or the chilled water cooling system.

VII AUXILIARY SYSTEMS
F2 Auxiliary and Radwaste Area Ventilation System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.F2-1 (A-09)	VII.F2.4-a	Ducting and components	Stainless steel	Condensation	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F2-2 (A-10)	VII.F2.1-a VII.F2.4-a	Ducting and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F2-3 (A-08)	VII.F2.1-a VII.F2.4-a	Ducting and components internal surfaces	Steel	Condensation (Internal)	Loss of material/ general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
VII.F2-4 (A-105)	VII.F2.1-a	Ducting closure bolting	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F2-5 (A-73)	VII.F2.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (External)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F2-6 (A-18)	VII.F2.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F2-7 (A-17)	VII.F2.1-b VII.F2.4-b	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal/ External)	Hardening and loss of strength/ elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F2-8 (AP-41)	VII.F2.	Heat exchanger components	Steel	Air – indoor uncontrolled (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No

VII AUXILIARY SYSTEMS
F2 Auxiliary and Radwaste Area Ventilation System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.F2-9 (A-63)	VII.F2.	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F2-10 (AP-80)	VII.F2.	Heat exchanger tubes	Copper Alloy	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F2-11 (AP-77)	VII.F2.	Heat exchanger tubes	Steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F2-12 (AP-74)	VII.F2.	Piping, piping components, and piping elements	Aluminum	Condensation	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F2-13 (AP-12)	VII.F2.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F2-14 (A-46)	VII.F2.2-a	Piping, piping components, and piping elements	Copper alloy	Condensation (External)	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F2-15 (AP-43)	VII.F2.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.F2-16 (AP-31)	VII.F2.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No

VII AUXILIARY SYSTEMS
F2 Auxiliary and Radwaste Area Ventilation System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.F2-17 (AP-30)	VII.F2.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.F2-18 (A-25)	VII.F2.3-a	Piping, piping components, piping elements, and tanks	Steel	Closed cycle cooling water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

F3. PRIMARY CONTAINMENT HEATING AND VENTILATION SYSTEM

Systems, Structures, and Components

This section discusses the primary containment heating and ventilation system (with warm moist air as the normal environment), which contains ducts, piping and fittings, equipment frames and housings, flexible collars and seals, filters, and heating and cooling air handlers. Based on Regulatory Guide 1.26, “Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants,” all components that comprise the primary containment heating and ventilation system are governed by Group C Quality Standards.

With respect to filters and seals, these items are to be addressed consistent with the Nuclear Regulatory Commission (NRC) position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of the Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system filters and seals are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The systems that interface with the primary containment heating and ventilation system are the closed-cycle cooling water system (VII.C2) and the PWR and BWR containments (II.A and II.B, respectively). The cooling coils receive their cooling water from other systems, such as the hot water heating system or the chilled water cooling system.

VII AUXILIARY SYSTEMS
F3 Primary Containment Heating and Ventilation System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.F3-1 (A-09)	VII.F3.4-a	Ducting and components	Stainless steel	Condensation	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F3-2 (A-10)	VII.F3.1-a VII.F3.4-a	Ducting and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F3-3 (A-08)	VII.F3.4-a VII.F3.1-a	Ducting and components internal surfaces	Steel	Condensation (Internal)	Loss of material/ general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
VII.F3-4 (A-105)	VII.F3.1-a	Ducting closure bolting	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F3-5 (A-73)	VII.F3.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (External)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F3-6 (A-18)	VII.F3.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F3-7 (A-17)	VII.F3.1-b VII.F3.4-b	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal/ External)	Hardening and loss of strength/ elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F3-8 (AP-34)	VII.F3.	Heat exchanger components	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No

VII AUXILIARY SYSTEMS F3 Primary Containment Heating and Ventilation System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.F3-9 (AP-65)	VII.F3.	Heat exchanger components	Copper alloy >15% Zn	Treated water	Loss of material/ selective leaching	Chapter XI.M33, “Selective Leaching of Materials”	No
VII.F3-10 (AP-41)	VII.F3.	Heat exchanger components	Steel	Air – indoor uncontrolled (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F3-11 (A-63)	VII.F3.	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F3-12 (AP-80)	VII.F3.	Heat exchanger tubes	Copper Alloy	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F3-13 (AP-77)	VII.F3.	Heat exchanger tubes	Steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F3-14 (AP-74)	VII.F3.	Piping, piping components, and piping elements	Aluminum	Condensation	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F3-15 (AP-12)	VII.F3.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, “Closed-Cycle Cooling Water System”	No
VII.F3-16 (A-46)	VII.F3.2-a	Piping, piping components, and piping elements	Copper alloy	Condensation (External)	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific

VII AUXILIARY SYSTEMS
F3 Primary Containment Heating and Ventilation System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.F3-17 (AP-43)	VII.F3.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.F3-18 (A-50)	VII.F3.	Piping, piping components, and piping elements	Gray cast iron	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.F3-19 (AP-30)	VII.F3.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.F3-20 (A-25)	VII.F3.3-a	Piping, piping components, piping elements, and tanks	Steel	Closed cycle cooling water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

F4. DIESEL GENERATOR BUILDING VENTILATION SYSTEM

Systems, Structures, and Components

This section discusses the diesel generator building ventilation system (with warm moist air as the normal environment), which contains ducts, piping and fittings, equipment frames and housings, flexible collars and seals, and heating and cooling air handlers. Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the diesel generator building ventilation system are governed by Group C Quality Standards.

With respect to seals, these items are to be addressed consistent with the Nuclear Regulatory Commission (NRC) position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system seals are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

The system that interfaces with the diesel generator building system is the auxiliary and radwaste area ventilation system (VII.F2). The cooling coils receive their cooling water from other systems, such as the hot water heating system or the chilled water cooling system.

VII AUXILIARY SYSTEMS F4 Diesel Generator Building Ventilation System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.F4-1 (A-10)	VII.F4.1-a	Ducting and components external surfaces	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F4-2 (A-08)	VII.F4.1-a	Ducting and components internal surfaces	Steel	Condensation (Internal)	Loss of material/ general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No
VII.F4-3 (A-105)	VII.F4.1-a	Ducting closure bolting	Steel	Air – indoor uncontrolled (External)	Loss of material/ general corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.F4-4 (A-73)	VII.F4.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (External)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F4-5 (A-18)	VII.F4.1-c	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal)	Loss of material/ wear	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F4-6 (A-17)	VII.F4.1-b	Elastomer seals and components	Elastomers	Air – indoor uncontrolled (Internal/ External)	Hardening and loss of strength/ elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F4-7 (AP-41)	VII.F4.	Heat exchanger components	Steel	Air – indoor uncontrolled (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No

VII AUXILIARY SYSTEMS F4 Diesel Generator Building Ventilation System							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.F4-8 (A-63)	VII.F4.	Heat exchanger components	Steel	Closed cycle cooling water	Loss of material/ general, pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.F4-9 (AP-77)	VII.F4.	Heat exchanger tubes	Steel	Closed cycle cooling water	Reduction of heat transfer/ fouling	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.F4-10 (AP-74)	VII.F4.	Piping, piping components, and piping elements	Aluminum	Condensation	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F4-11 (AP-12)	VII.F4.	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material/ pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No
VII.F4-12 (A-46)	VII.F4.2-a	Piping, piping components, and piping elements	Copper alloy	Condensation (External)	Loss of material/ pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
VII.F4-13 (AP-43)	VII.F4.	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No
VII.F4-14 (AP-31)	VII.F4.	Piping, piping components, and piping elements	Gray cast iron	Treated water	Loss of material/ selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No

VII AUXILIARY SYSTEMS
F4 Diesel Generator Building Ventilation System

Item	Link	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
VII.F4-15 (AP-30)	VII.F4.	Piping, piping components, and piping elements	Steel	Lubricating oil	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis" The AMP is to be augmented by verifying the effectiveness of the lubricating oil analysis program. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
VII.F4-16 (A-25)	VII.F4.3-a	Piping, piping components, piping elements, and tanks	Steel	Closed cycle cooling water	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M21, "Closed-Cycle Cooling Water System"	No

G. FIRE PROTECTION

Systems, Structures, and Components

This section discusses the fire protection systems for both boiling water reactors (BWRs) and pressurized water reactors (PWRs), which consist of several Class 1 structures, mechanical systems, and electrical components. The Class 1 structures include the intake structure, the turbine building, the auxiliary building, the diesel generator building, and the primary containment. Structural components include fire barrier walls, ceilings, floors, fire doors, and penetration seals. Mechanical systems include the high pressure service water system, the reactor coolant pump oil collect system, and the diesel fire system. Mechanical components include piping and fittings, filters, fire hydrants, mulsifiers, pumps, sprinklers, strainers, and valves (including containment isolation valves). Based on Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components that comprise the fire protection system are governed by Group C Quality Standards.

With respect to filters, seals, portable fire extinguishers, and fire hoses, these items are to be addressed consistent with the NRC position on consumables, provided in the NRC letter from Christopher I. Grimes to Douglas J. Walters of Nuclear Energy Institute (NEI), dated March 10, 2000. Specifically, components that function as system filters, seals, portable fire extinguishers, and fire hoses are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii). As part of the methodology description, the application should identify the standards that are relied on for replacement, for example, National Fire Protection Association (NFPA) standards for fire protection equipment.

Pump and valve internals perform their intended functions with moving parts or with a change in configuration. They are also subject to replacement based on qualified life or specified time period. Pursuant to 10 CFR 54.21(a)(1), therefore, they are not subject to an aging management review.

Aging management programs for the degradation of external surfaces of components and miscellaneous bolting are included in VII.I. Common miscellaneous material/environment combinations where aging effects are not expected to degrade the ability of the structure or component to perform its intended function for the extended period of operation are included in VII.J.

The system piping includes all pipe sizes, including instrument piping.

System Interfaces

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

VII AUXILIARY SYSTEMS G Fire Protection							
Item	**Link**	**Structure and/or Component**	**Material**	**Environment**	**Aging Effect/ Mechanism**	**Aging Management Program (AMP)**	**Further Evaluation**
VII.G-1 (A-19)	VII.G.3-a VII.G.1-a VII.G.2-a VII.G.4-a	Fire barrier penetration seals	Elastomers	Air – indoor uncontrolled	Increased hardness, shrinkage and loss of strength/ weathering	Chapter XI.M26, “Fire Protection”	No
VII.G-2 (A-20)	VII.G.1-a VII.G.3-a VII.G.4-a VII.G.2-a	Fire barrier penetration seals	Elastomers	Air – outdoor	Increased hardness, shrinkage and loss of strength/ weathering	Chapter XI.M26, “Fire Protection”	No
VII.G-3 (A-21)	VII.G.2-d VII.G.5-c VII.G.3-d VII.G.4-d VII.G.1-d	Fire rated doors	Steel	Air – indoor uncontrolled	Loss of material/ wear	Chapter XI.M26, “Fire Protection”	No
VII.G-4 (A-22)	VII.G.1-d VII.G.2-d VII.G.4-d VII.G.3-d	Fire rated doors	Steel	Air – outdoor	Loss of material/ wear	Chapter XI.M26, “Fire Protection”	No
VII.G-5 (AP-41)	VII.G.	Heat exchanger components	Steel	Air – indoor uncontrolled (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.G-6 (AP-40)	VII.G.	Heat exchanger components	Steel	Air – outdoor (External)	Loss of material/ general, pitting, and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring"	No
VII.G-7 (AP-61)	VII.G.	Heat exchanger tubes	Stainless steel	Raw water	Reduction of heat transfer/ fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No
VII.G-8 (AP-83)	VII.G.	Piping, piping components, and piping elements	Aluminum	Raw water	Loss of material/ pitting and crevice corrosion	Chapter XI.M26, “Fire Protection”	No