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Mr. Christopher I. Grimes
Chief, License Renewal and Standardization Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20006

SUBJECT: Generic Aging Lessons Learned Report Comments

PROJECT NUMBER: 690

Dear Mr. Grimes:

Enclosed are comments on all sections of Chapters V and VIII of the Generic Aging Lessons Learned (GALL) Report. Two documents are provided for each chapter. One document is a mark-up of the existing GALL pages to reflect our comments. Each comment is identified by number. The second document is a table containing our comments, numbered consistent with the marked-up pages.

We have experienced significant incompatibility issues in formatting. We had initially planned to develop clean copies of the GALL pages to reflect how GALL reads with our comments incorporated. The transition between Word for McIntosh, the format from the NRC contractor, and our Word for PC format has proven essentially untenable. We continue to wrestle with Chapter VII, however, we have exhausted practically every formatting option. In the interest of ensuring you receive the industry comments in a timely fashion, we will send, at a minimum, the mark up and the comments for Chapter VII by week's end.

We look forward to discussing the enclosed comments with the NRC staff. If you have any questions please call Bob Evans at 202. 739-8101.

Sincerely,

Douglas J. Walters

Douglas J. Walters

C: Mr. Sam Lee
Mr. P.T.Kuo

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CHAPTER V

(12/06/99)

ENGINEERED SAFETY FEATURES

Major Plant Sections

A. Containment Spray System

B. Standby Gas Treatment System (Boiling Water Reactor)

C. Containment Isolation Components

D1. Emergency Core Cooling System (Pressurized Water Reactor)

D2. Emergency Core Cooling System (Boiling Water Reactor)

E. Fan Cooler System

A Containment Spray System

A.1 Containment Spray System

A.1.1 Piping and Fittings up to Isolation Valve

A.1.2 Flow Orifice/Elements

A.1.3 Temperature Elements/Indicators

A.1.4 Bolting

A.1.5 Eductors

A.2 Header and Spray Nozzles System

A.2.1 Piping and Fittings

A.2.2 Flow Orifice

A.2.3 Headers

A.2.4 Spray Nozzles

A.3 Chemical Addition System

A.3.1 Piping and Fittings

A.3.2 Storage Tank

A.4 Pumps

A.4.1 Bowl/Casing

A.4.2 Bolting

A.5 Valves (Hand, Control, Check, Motor-Operated) (in Containment Spray System)

A.5.1 Body and Bonnet

A.5.2 Bolting

A.6 Valves (Hand, Control) (in Header and Spray Nozzle System)

A.6.1 Body and Bonnet

A.6.2 Bolting

A.7 Containment Spray Heat Exchanger

A.7.1 Bonnet/Cover

A.7.2 Tubing

A.7.3 Shell

A.7.4 Case/Cover

A.7.5 Bolting

A Containment Spray System (Pressurized Water Reactors)

System, Structures, and Components

The system, structures, and components included in this table comprise the containment spray system for pressurized water reactors (PWRs) designed to limit the pressure and temperature of the containment atmosphere following a design basis-event, and to remove heat from the reactor coolant system (RCS) during plant cooldown and to maintain the RCS temperature during plant shutdown. Spray systems using borated water and NaOH solutions are reviewed. The system consists of piping, valves, flow elements and orifices, pumps, spray nozzles, eductors, containment spray system heat exchanger (some plants), and chemical addition system. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the containment spray system outside the containment are classified as Group B Quality Standards and those inside the containment and up to the isolation valve are classified Group A Quality Standard. The aging management programs for the residual heat removel (RHR) heat exchanger, refueling water tank, and shutdown coolers are reviewed in Table V D1, and for the containment isolation valves in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the containment spray system are the emergency core cooling or safety injection system (Table V D1), coolant storage/refueling water system (Table VII E4), open- and closed-cycle cooling water system (Tables VII C1 and C2), containment isolation components (Table V C), and fan cooler system (Table V E).

DELETE

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.1 thru A.1.3	Containment Spray System	Piping and Fittings up to Isolation Valve, Flow Orifice/ Elements, Temperature Elements/ Indicators	Stainless Steel (SS)	Chemically Treated Borated Water at Maximum Design Temperature of ≈205°C	Local Loss of Material	Pitting and Crevice Corrosion	~~ASME Section XI, 1989 Edition.~~ NRC IN 84-18. Plant Technical Specifications. EPRI TR-105714.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Inservice inspection is in conformance~~ with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC-2500-1, examination category C-H for pressure retaining Class 2 components. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry and plant technical specifications for refueling water storage tank water chemistry.	~~(1) Scope of Program: The program relies on~~ measures to mitigate crevice or pitting corrosion and inservice inspection (ISI) to monitor the effects of corrosion on the intended function of containment spray system components. ***(2) Preventive Actions:*** Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential for pitting and crevice corrosion. ~~However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 94-16), or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation.~~ ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by control of system water chemistry and by detection of coolant leakage by inservice inspection (ISI). Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 2 components required to operate or support the safety function according to Table IWC 2500-1 category C-H. ~~***(4) Detection of Aging Effects:***~~ Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ~~The results of one-time inspection~~ should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repairs are in conformance with IWA-4000 and replacement according to IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR 50 and will continue to be adequate	~~Yes, Element 4 should be further evaluated~~ NO

CHEMISTRY CONTROL PROGRAM VA-2

(SEE CHAPTER #11)

SEE CHAPTER #11 FOR EVALUATION AND TECHNICAL BASIS FOR CHEM. CONTROL PROGRAM

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.1	Containment Spray System	Piping and Fittings up to Isolation Valve	Stainless Steel (SS)	Chemically Treated Borated Water at Maximum Design Temperature of ≈205°C	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	~~ASME Section XI, 1989 Edition,~~ Reg. Guide ~~1.44.~~ 1.43 NRC IN 79-19. NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19. EPRI TR-105714. Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] for the period of license renewal. ***(10) Operating Experience:*** Corrosion related degradation has not been reported for containment spray system components, but cracking has occurred in safety-related SS piping systems and portions of systems which contain oxygenated, [redacted]	
Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-F-1 for pressure retaining welds in Class 2 stainless steel piping. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry and plant technical specifications for refueling ~~water storage tank water chemistry.~~	***(1) Scope of Program:*** The program includes preventive measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of containment spray system components. ***(2) Preventive Actions:*** Selection of material in compliance with the guidelines of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. ~~However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 84-18), or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation.~~ ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on the intended function of the piping by control of system water chemistry and by detection and sizing of cracks by ISI. Inspection requirements of IWC 2500-1 category C-F-1, specify for circumferential and longitudinal welds in each pipe or branch run NPS 4 or larger, volumetric and surface examination of ID region, and surface examination of OD surface. Surface examination is conducted for circumferential and longitudinal welds in each pipe or branch run less than NPS 4. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment are in [redacted] Section XI, or any other formal program approved by the NRC. ***(4) Detection of Aging Effects:*** Degradation of piping and fittings due to SCC can not occur without crack initiation; inspection schedule assures detection of cracks before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWC-2400 should provide timely detection of cracks. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3514. Supplementary surface examination may be performed on [redacted] volumetric examination. ***(7) Corrective Actions:*** Repairs are in conformance with IWA-4000, replacement according to IWA-7000, and reexamination in accordance	No

CHEMISTRY CONTROL PROGRAM VA-2 (SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR CHEM. CONTROL PROGRAM

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.4	Containment Spray System	Bolting	Carbon Steel (CS), Low-Alloy Steel (LAS)	Air, Leaking Chemically Treated Borated Water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. NRC IN 86-108 S3. Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) with requirements of IWA-2200. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs has generally not been found to be affected by SCC because of control of primary water chemistry, cracking has occurred in safety injection lines (IN 97-19 and 84-18), charging pump casing cladding (INs 80-38 and 94-63), instrument nozzles in safety injection tanks (IN 91-05), and safety-related SS piping systems which contain oxygenated, stagnant, or essentially stagnant borated water (IN 97-19).	
Implementation of NRC Generic Letter 88-05 and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components.	***(1) Scope of Program:*** The staff guidance of Generic Letter (GL) 88-05 provides assurance that a program has been implemented consisting of systematic measures to ensure that the effects of corrosion caused by leaking ~~coolant~~ containing boric acid does not lead to degradation and provides assurance that the reactor ~~coolant pressure boundary~~ will have a extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture. The program includes (a) determination of principal location, (b) examinations requirements and procedures for locating small leaks, and (c) engineering evaluations and corrective actions. ***(2) Preventive Actions:*** Minimizing reactor ~~coolant~~ leakage by frequent monitoring of the locations where potential leakage could occur and repairing the leaky components as soon as possible, prevent or mitigate boric acid corrosion. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of boric acid corrosion on the intended function of the component by detection of ~~coolant~~ leakage by inservice inspection (ISI). Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure-retaining Class 2 components required to operate or support the safety function up to and including the first normally closed valve, according to Table IWC 2500-1 category C-H. ***(4) Detection of Aging Effects:*** Degradation of the component due to boric acid wastage can not occur without leakage of coolant containing boric acid; extent and schedule of inspection assure detection of leakage before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI should provide for timely detection of leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of	No

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.5	Containment Spray System	Eductors	SS	Chemically Treated Borated Water and NaOH Solution	Local Loss of Material	Pitting and Crevice Corrosion	ASME Section XI, 1989 Edition. NRC IN 84-18. Plant Technical Specifications. EPRI TR-105714.
A.1.5	Containment Spray System	Eductors	SS	Chemically Treated Borated Water and NaOH Solution	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	*Same as effects of SCC on containment spray system components (A.1.1-A.1.3).*
A.2.1 thru A.2.4	Header and Spray Nozzles System	Piping and Fittings, Flow Orifice, Headers, Spray Nozzles	CS, SS	Air	Loss of Material	General, Pitting, and Crevice Corrosion	Plant Technical Specifications.
A.3.1	Chemical Addition System	Piping and Fittings	SS	NaOH Solution at near Ambient Temperature	Crack Initiation and Growth	SCC	ASME Section XI, 1989 Edition. Regulatory Guide 1.44.

SEE V A-1

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) IWB-3142 and IWA-5250. The leakage source and areas of general corrosion are located. Components with local areas of corrosion that reduces the wall thickness by more than 10% require analytical evaluation to demonstrate acceptability. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Boric acid wastage observed in nuclear power plants may be classified into two distinct types: (a) corrosion that increases the rate of leakage, e.g., corrosion of closure bolting or fasteners in reactor coolant pressure boundary, and (b) corrosion that occurs some distance from the source of leakage. Some recent incidents of boric acid wastage (IN 86-108 S3) at Calvert Cliffs Unit 1 (Feb. 1994) and Three Mile Island Unit 1 (March 1994) indicate that, although implementation of GL 88-05 ensures timely detection of leakage, there may still be a lack of awareness of the conditions that can lead to boric acid wastage.	
Same as effects of Pitting and Crevice Corrosion on containment spray system piping and fittings (A.1.1), flow orifice/elements (A.1.2), temperature elements/indicators (A.1.3).	*Same as effects of Pitting and Crevice Corrosion on containment spray system piping and fittings (A.1.1), flow orifice/elements (A.1.2), temperature elements/indicators (A.1.3).*	~~Yes, Element 4 should be further evaluated~~ NO VA-2
Same as effects of SCC on containment spray system components (A.1.1-A.1.3).	*Same as effects of SCC on containment spray system components (A.1.1-A.1.3).*	No
Plant specific aging management program.	Plant specific aging management program is to be evaluated. SEE VA-1	Yes, no AMP
~~Guidelines of Regulatory Guide (RG) 1.44~~ to avoid sensitization of stainless steels (SSs) and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Subsection IWC, Table IWC 2500-1, examination category C-F-1 for pressure retaining welds in austenitic ~~stainless steel and high alloy~~ piping.	~~(1) Scope of Program: The program includes~~ measures to mitigate SCC of SS components, and inservice inspection (ISI) to monitor the effects of SCC on the intended function of piping and fittings and connected lines. ***(2) Preventive Actions:*** Selection of material in compliance with the guidelines of Regulatory Guide (RG) 1.44 to prevent or mitigate SCC. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on the intended function of the piping by detection and sizing of cracks by ISI. Inspection requirements of IWC 2500-1 category C-F-1, specify for circumferential and longitudinal welds in each pipe or branch run NPS 4 or larger, volumetric and surface examination of ID region, and surface examination of OD surface. Requirements for ~~training and qualification of personnel and performance~~ demonstration for procedures and equipment are	No

SEE CHAPTER #11 FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM

SEE CHAPTER #11 CHEMISTRY CONTROL PROGRAM VA-2

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.3.2	Chemical Addition System	Storage Tank	SS	NaOH Solution at near Ambient Temperature	Crack Initiation and Growth	SCC	ASME Section XI, 1989 Edition. Regulatory Guide 1.44.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) in conformance with Appendices VII and VIII of ASME Section XI, or any other formal program approved by the NRC. ***(4) Detection of Aging Effects:*** Degradation of the piping due to SCC can not occur without crack initiation. The extent of inspection required by ASME Section XI is considered adequate to detect cracking of susceptible SS components and cladding in the weld regions. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWC-2400 should provides timely detection of cracks. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing test results with the acceptance standards of IWC-3400. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWC-3133, and reexamination in accordance with requirements of IWA-2200. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant cracking has been reported for chemical addition lines in PWRs.	
Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components.	***(1) Scope of Program:*** The program includes preventive measures to mitigate stress corrosion cracking (SCC) and inservice inspection (ISI) to monitor the effects of SCC on the storage tank. ***(2) Preventive Actions:*** Selection of material in compliance with the guidelines of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of SCC by detection of leakage. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H. ***(4) Detection of Aging Effects:*** Degradation of the component due to SCC can not occur without leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any	Yes, Element 4 should be further evaluated

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.4.1	Pump	Bowl/Casing	SS	Chemically Treated Borated Water	Local Loss of Material	Pitting and Crevice Corrosion	~~ASME Section XI, 1989 Edition.~~ ASME OM Code-1990, Subsection ISTB. NRC GL 89-04. NRC IN 84-18. NRC IN 96-11. EPRI TR-105714. Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516. Any evidence of aging effects or unacceptable results should be evaluated. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant cracking has been reported for chemical addition storage tanks in PWRs.	
~~Inservice inspection is in conformance~~ with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components, and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 pumps, and additional NRC staff guidelines of NRC Generic Letter 89-04, inservice testing performed in accordance with ASME Subsection IWP (or Operation and Maintenance Code Subsection ISTB) for pumps, or other approved program in the plant specifications. Water chemistry program based on EPRI guidelines of TR-105714 for minimizing impurities by monitoring and maintaining ~~primary water chemistry~~.	~~(1) Scope of Program:~~ The program relies on preventive measures to mitigate crevice or pitting corrosion and a combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of containment spray system components. ***(2) Preventive Actions:*** Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential for pitting and crevice corrosion. ~~However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool [NRC Information Notice (IN) 94-10] ... from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation.~~ ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of corrosion by control of water chemistry and by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 2 components required to operate or support the safety function according to Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 2 pumps and additional guidelines of NRC Generic Letter (GL) 89-04, IST is performed in accordance with ASME Subsection IWP (or ASME Code Subsection ISTB). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant or degradation of pump performance. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of	~~Yes, Element 4 should be further evaluated~~ NO VA-2

CHEMISTRY CONTROL PROGRAM VA-2 (SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.4.1	Pump	Bowl/Casing	SS	Chemically Treated Borated Water	Crack Initiation and Growth	SCC	~~ASME Section XI, 1989 Edition.~~ Reg. Guide 1.44. NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19. EPRI TR-105714 Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516. ***(7) Corrective Actions:*** Repairs are in conformance with IWA-4000, replacement according to IWA-7000, and reexamination in accordance with requirements of IWA-2200. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at flange connections where buildup of impurities can occur.	
Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-G for pressure retaining welds in pumps. Water chemistry program based on EPRI guidelines of TR-105714 for minimizing impurities by monitoring and maintaining primary water chemistry.	~~***(1) Scope of Program:*** The program includes~~ measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of containment spray system components. ~~***(2) Preventive Actions:***~~ Selection of material in compliance with the guidelines of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. ~~However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 84-18), or from water from the sump. The AMP must therefore rely upon [illegible] in accordance with ASME Section XI [illegible] degradation.~~ ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of SCC on intended function of the pump by control of primary water chemistry and by detection and sizing of cracks by ISI. Inspection requirements of IWC 2500-1 category C-G, specifies surface examination of either the inside or outside surface of all welds extending 1/2 in. on either side of the weld. In a group of multiple pumps of similar design, size, function, and service in a system, examination of only one pump is required. ***(4) Detection of Aging Effects:*** Degradation of pumps due to SCC can not occur without crack initiation and growth; ISI schedule assures detection of cracks before the loss of intended function of the pump. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWC-2400 should provide timely detection ·	No

CHEMISTRY CONTROL PROGRAM VA-2 (SEE CHAPTER II)

SEE CHAPTER II FOR THE EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.4.1	Pump	Bolting	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Corrosion/ Boric Acid Wastage	NRC GL 88-05. ~~ASME Section XI, 1989 Edition.~~ NRC IN 86-108 S3, Plant Technical Specifications.
A.5.1	Valves (Hand, Control, Check, and Motor-Operated Valves) (in Containment Spray System)	Body and Bonnet	SS	Chemically Treated Borated Water	Local Loss of Material	Pitting and Crevice Corrosion	~~ASME Section XI, 1989 Edition.~~ ASME OM Code-1990, Appendix I and Subsection ISTC. NRC GL 89-04. NRC GL 96-05. NRC IN 84-18. NRC IN 88-70. NRC IN 94-63. NRC IN 98-23. EPRI TR-105714 Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] of cracks. Surface examination of welds is conducted during each inspection interval. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3515. ***(7) Corrective Actions:*** Repairs are in conformance with IWA-4000, replacement according to IWA-7000, and reexamination in accordance with requirements of IWA-2200. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels, potential of SCC exists from inadvertent introduction of contaminants into the primary coolant system (IN 84-18). SCC has been observed in safety injection lines (IN 97-19 and 84-18), charging pump casing cladding (INs 80-38 and 94-63), and instrument nozzles in safety injection tanks (IN 91-05).	
Same as effects of Corrosion/Boric Acid Wastage on containment spray system bolting (A.1.4).	*Same as effects of Corrosion/Boric Acid Wastage on containment spray system bolting (A.1.4).*	No
Inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 valves, staff guidelines of NRC Generic Letter (GL) 89-04 regarding the scope of inservice testing (IST), and information in NRC IN 88-70 regarding scope and testing of safety-related check valves, and GL 96-05 regarding safety-related motor-operated valves. IST is performed in accordance with ASME Subsection IWV (Operation and Maintenance Code Appendix I and Subsection ISTC), to ensure that the changes in design-basis performance of safety-related valves resulting from degradation can be identified and managed. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry.	[redacted] measures to mitigate crevice or pitting corrosion and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of containment spray components. **(2) Preventive Actions:** Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down mitigate potential for pitting and crevice corrosion. ~~However, inadvertent introduction of contaminants into the coolant system can occur, e.g. contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 84-18), or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation. [redacted] Parameters Monitored/Inspected: The AMP monitors~~ the effects of corrosion by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 2 valves and additional guidelines of NRC GLs	Yes, Element 4 should be further evaluated

(SEE CHAPTER #11 CHEMISTRY PROGRAM)

CONTROL

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM

JA-2

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.5.1	Valves (Hand, Control, Check, and Motor-Operated Valves) (in Containment Spray System)	Body and Bonnet	SS	Chemically Treated Borated Water	Crack Initiation and Growth	SCC	~~ASME Section XI, 1989 Edition.~~ Reg. Guide ~~1.44~~ 1.43 NRC IN 84-18. NRC IN 89-02. NRC IN 97-19. EPRI TR-105714. Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] 89-04 and 96-05. IST is performed in accordance with ASME Subsection IWV (OM Code Appendix I and Subsection ISTC). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repairs are in conformance with IWA-4000 and repair according to IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Corrosion has been observed in guide rings of relief valves (IN 98-23) and charging pump casing (IN 94-63).	
~~Guidelines of Regulatory Guide (RG) 1.44~~ to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-G for pressure retaining welds in Class 2 valves. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water ~~chemistry~~.	[redacted] The program includes preventive measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of SCC on the intended function of containment spray system components. ***(2) Preventive Actions:*** Selection of material in compliance with the guidelines of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. However, inadvertent introduction of contaminants into the coolant system can occur either as contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 84-18), or from water from the sump. The AMP must therefore rely	No

SEE CHAPTER #11

CHEMISTRY CONTROL PROGRAM VA-2

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.5.2	Valves (Hand, Control, Check, and Motor-Operated Valves) (in Containment Spray System)	Bolting	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Corrosion/ Boric Acid Wastage	NRC GL 88-05. ASME Section XI, 1989 Edition. NRC IN 86-108 S3, Plant Technical Specifications.
A.6.1	Valves (Hand and Control) (in Header and Spray Nozzles System)	Body and Bonnet	CS	Air	Loss of Material	General, Pitting, and Crevice Corrosion	Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) upon ISI in accordance with ASME Section XI to detect possible degradation. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on the intended function of the valves by detection and sizing of cracks by ISI. Inspection requirements of Table IWC 2500-1, category C-G specify for all valves in each piping run examined under category C-F, surface examination of either the inside or outside surface of all welds extending 1/2 in. on either side of the weld. In a group of multiple valves of similar design, size, function, and service in a system, examination of only one valve is required. ***(4) Detection of Aging Effects:*** Degradation of valves due to SCC can not occur without crack initiation and growth; ISI schedule assures detection of cracks before the loss of intended function of the valves. ***(5) Monitoring and Trending:*** provide timely detection of cracks. All welds are inspected each inspection period from at least one valve in each group with similar design and performing similar functions in the system. Visual examination is required only when the valve is disassembled for maintenance, repair, or volumetric examination, but at least once during the period. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3515 for surface examination of welds in Class 2 valves. ***(7) Corrective Actions:*** Repairs are in conformance with IWA-4000 and replacement according to IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels and control of primary water chemistry, cracking has occurred in safety injection lines (IN 97-19 and 84-18), internal bolting in swing check valves (IN 89-02), and safety-related SS piping systems which contain oxygenated, stagnant, or essentially stagnant borated water (IN 97-19).	
Same as effects of Corrosion/Boric Acid Wastage on containment spray system bolting (A.1.4).	*Same as effects of Corrosion/Boric Acid Wastage on containment spray system bolting (A.1.4).*	No
Plant specific aging management program.	Plant specific aging management program is to be evaluated.	Yes, no AMP

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.7.1 thru A.7.4	Containment Spray Heat Exchanger (Serviced by Closed Cycle Cooling Water)	Bonnet/Cover, Tubing, Shell, Case/Cover	CS, SS	Chemically Treated Borated Water; and Closed Cycle Cooling Water Treated Water)	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ ASME OM S/G, Pt 2. NRC GL 89-13. EPRI TR-105714. Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Detection of reactor coolant leakage by temperature monitors in component cooling system; inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; performance testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably; and water chemistry control program based on EPRI TR-105714 for primary water and plant technical specifications for cooling water.	~~Scope of Program: The program includes monitoring and~~ control of water chemistry and cooling water chemistry to minimize exposure to aggressive environments, and performance testing in accordance with ASME OM Standards and Guides, Part 2 provides assurance that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably. If adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to include inspection and maintenance program to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety-related systems serviced by closed-cycle cooling water. ***(2) Preventive Actions:*** Use of appropriate materials, lining or coating to protect the underlying metal surfaces, and control of primary water chemistry and cooling water chemistry to minimize exposure to aggressive environment. The parameters monitored include halogens, sulfates, oxygen, and pH in the primary water, and in addition to these, dissolved copper and iron, and suspended solids, in the component cooling water. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to ~~evaluate component performance. The parameters~~ monitored are directly related to corrosion, e.g., dissolved iron and copper, and by detection of leakage by temperature monitors, in the component cooling system. Also, inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H. Performance testing is conducted in accordance with ASME OM S/G, Part 2. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance. Monitoring of temperature and suspended solids would detect the existence of corrosion; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify the heat transfer capabilities are trended. Also, based on the recommendations of NRC GL 89-13 or its equivalent, if adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to include inspection and maintenance program for closed-cycle cooling water system to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety-related systems serviced by closed-cycle cooling water. ***(6) Acceptance Criteria:*** Heat exchanger performance test results are evaluated in accordance with the guidelines of ASME OM S/G Part 2. Results of Section XI leakage tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWC-3516 for Class 2 components. ***(7) Corrective Actions:*** If the heat	No

CHEMISTRY CONTROL PROGRAM VA-2 (SEE CHAPTER 11 #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.7.1 thru A.7.4	Containment Spray Heat Exchanger (Serviced by Open Cycle Cooling Water)	Bonnet/Cover, Tubing, Shell, Case/Cover	CS, SS	Chemically Treated Borated Water; and Open Cycle Cooling Water (Raw Water)	Loss of Material	General and Microbiologically influenced Corrosion	NRC GL 89-13. EPRI TR-105714. Plant Technical Specifications. *Operating Experience* NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96. NRC IN 94-03.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) exchanger fails to perform adequately, corrective actions are taken in accordance with OM S/G Part 2. Root cause evaluation and appropriate corrective actions are taken when acceptable limits are exceeded or leakage is detected. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Operating plant experience with this AMP indicates timely detection of corr[illegible] containment spray [illegible] exchangers.	
The program relies on preventive measures to mitigate corrosion by monitoring and control of water chemistry to minimize exposure to aggressive environments, and implementation of the recommendations of Generic Letter 89-13 or an equally effective program to ensure that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Water chemistry control program based on EPRI TR-105714 for primary water and plant technical specifications for cooling water.	***(1) Scope of Program:*** The program includes monitoring and control of water chemistry to minimize exposure to aggressive environments, and staff recommendations of Generic Letter (GL) 89-13 or an equivalent program provide assurance that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Guidelines of GL 89-13 include (a) surveillance and control of biofouling, (b) test program to verify heat transfer capabilities, (c) routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling, can not degrade the performance of safety-related systems serviced by open-cycle cooling water, (d) system walkdown inspection to ensure compliance with licensing basis, and review of maintenance, operating, and training practices and procedures. ***(2) Preventive Actions:*** The component is constructed of appropriate materials, control of secondary side water chemistry, and lining or coating protect the underlying metal surfaces from being exposed to aggressive cooling water environment. Based on GL 89-13 cooling water system is continuously chlorinated or treated with biocide whenever the potential for biological fouling species exists. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. Based on recommendations of GL 89-13 or its equivalent, cooling water system is inspected for biofouling organisms, sediment, protective coating failure, and corrosion; and cooling water flow and temperature are monitored for component performance evaluation to ensure that flow blockage or excessive fouling accumulation does not exist. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify heat transfer capabilities are trended. ***(6) Acceptance Criteria:*** Any relevant conditions related to corrosion or leakage are compared to established acceptable limits. Maximum levels for various impurities [illegible] secondary side water and cooling water	No

CHEMISTRY CONTROL PROGRAM IA-2 (SEE CHAPTER #11)

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.7.1 thru A.7.4	Containment Spray Heat Exchanger (Serviced by Open Cycle Cooling Water)	Bonnet/Cover, Tubing, Shell, Case/Cover	CS, SS	Chemically Treated Borated Water; and Open Cycle Cooling Water (Raw Water)	Buildup of Deposit	Biofouling	*Same as effect of general and microbiologically influenced corrosion on containment spray heat exchanger components (A.7.1-A.7.4).*
A.7.3 thru A.7.5	Containment Spray Heat Exchanger	Shell, Case/Cover, (External Surfaces); Bolting	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. NRC IN 86-108 S3. Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

A. CONTAINMENT SPRAY SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] are specified. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken. Root cause evaluation is performed when acceptable limits are exceeded or leakage is detected. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Significant microbiologically influenced corrosion [NRC Information Notice (IN) 85-30], failure of protective coatings (IN 85-24), and fouling (IN 81-21, 86-96) has been observed in a number of heat exchangers. Although the AMP provides an effective means to manage the effects of corrosion on the intended function of heat exchangers, results of service water system operational performance inspections (IN 94-03) indicate that deficien[redacted] of GL 89-13.	
Same as effect of general and microbiologically influenced corrosion on containment spray heat exchanger components (A.7.1-A.7.4).	*Same as effect of general and microbiologically influenced corrosion on containment spray heat exchanger components (A.7.1-A.7.4).*	No
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5*	No

B Standby Gas Treatment System (Boiling Water Reactor)

- B.1 Ductwork and Dampers
- B.2 Electric Heater
- B.3 Filters
  - B.3.1 Filter Housing and Supports
  - B.3.2 Charcoal Absorber Filter
  - B.3.3 Elastomer Seals
- B.4 Fan

B. Standby Gas Treatment System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the standby gas treatment system found in boiling water reactors (BWRs) and consist of ductwork, dampers, electrical heaters, filters, fans, and associated instrumentation and controls. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the standby gas treatment system are classified as Group B Quality Standards.

System Interfaces

The system that interfaces with the standby gas treatment system is the containment isolation components system (Table V C).

V ENGINEERED SAFETY FEATURES

B. STANDBY GAS TREATMENT SYSTEMS (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B.1	Ductwork and dampers	Internal and external surfaces	Carbon steel	Internal: Occasional exposure to Moist Air; External: Ambient Plant Air Environment	Loss of Material	General Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.
B.1	Ductwork and dampers	Internal and external surfaces	Carbon steel	Internal: Occasional exposure to Moist Air; External: Ambient Plant Air Environment	Local Loss of Material	Crevice Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.
B.1	Ductwork and dampers	Internal and external surfaces	Carbon steel	Internal: Occasional exposure to Moist Air; External: Ambient Plant Air Environment	Local Loss of Material	Pitting Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.
B.2	Electric Heater	Housing	Stainless steel	Occasional exposure to Moist Air and entrained impurities at elevated temperature	Crack Initiation and Growth	Stress Corrosion Cracking	
B.3.1	Filters	Filter housing and supports	Carbon and stainless steel	Internal: Occasional exposure to Moist Air; External: Ambient Plant Air Environment	Loss of Material	General Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.
B.3.1	Filters	Filter housing and supports	Carbon and stainless steel	Internal: Occasional exposure to Moist Air; External: Ambient Plant Air Environment	Local Loss of Material	Crevice Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.

V ENGINEERED SAFETY FEATURES

B. STANDBY GAS TREATMENT SYSTEMS (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
NRC Reg. Guide 1.52 recommends operation of the Standby Gas Treatment System (SGTS) at 70% relative humidity or less to prevent condensation on interior surfaces (see NRC IN 82-43). Otherwise, the methodologies for the prevention and detection of degradation in the SGTS components are covered in plant-specific preventative maintenance and inspection programs.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Methodologies for the prevention and detection of degradation in the SGTS components are covered in plant-specific preventative maintenance and inspection programs.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP

V ENGINEERED SAFETY FEATURES

B. STANDBY GAS TREATMENT SYSTEMS (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B.3.1	Filters	Filter housing and supports	Carbon and stainless steel	Internal: Occasional exposure to Moist Air; External: Ambient Plant Air Environment	Local Loss of Material	Pitting Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.
B.3.2	Filters	Charcoal absorber filter	Activated charcoal	Occasional exposure to Moist Air	Loss of Iodine Retention Capacity	Absorption of Moisture	NRC Reg. Guide 1.52. NRC IN 82-43.
B.3.3	Filters	Elastomer Seals	Elastomers (neoprene and similar materials)	Occasional exposure to Moist Air	Changes in Hardness, Compression Strength, and other Physical Properties	Elastomer Degradation	
B.4	Fan	Internal components	Carbon steel	Occasional exposure to Moist Air	Loss of Material	General Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.
B.4	Fan	Internal components	Carbon steel	Occasional exposure to Moist Air	Local Loss of Material	Crevice Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.
B.4	Fan	Internal components	Carbon steel	Occasional exposure to Moist Air	Local Loss of Material	Pitting Corrosion	NRC Reg. Guide 1.52. NRC IN 82-43.

V ENGINEERED SAFETY FEATURES

B. STANDBY GAS TREATMENT SYSTEMS (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Methodologies for the prevention and detection of degradation in the SGTS components are covered in plant-specific preventative maintenance and inspection programs.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP
Same as the effect of general corrosion on Item B.1, Ductwork and Dampers.	Plant-specific preventative maintenance and inspection programs will be evaluated.	Yes. No generic AMP

C. Containment Isolation Components

C.1 Personnel Hatch

C.1.1 Hatchway

C.1.2 Inner Door

C.1.3 Outer Door

C.2 Equipment Hatch

C.2.1 Hatchway

C.2.2 Cover Plate

C.3 Mechanical (pipe) Penetrations

C.3.1 Sleeve

C.3.2 Seal

C.3.3 Closure Plate

C.3.4 Anchors

C.3.5 Fasteners

C.4 Electrical Penetrations

C.4.1 Sleeve

C.4.2 Header Plate

C.4.3 Seal

C.4.4 Anchors

C.5 Fuel Transfer Penetrations

C.5.1 Sleeve

C.5.2 Closure Plate

C.5.3 Anchors

C.6 Purge/Vent

C.6.1 Seal

C.7 Leak Testing (Penetration, Integrated, & Isolation Valve Leak Test Systems)

C.7.1 Mechanical Penetrations

C.7.2 Sleeves

C.7.3 Seal

C.8 Isolation Barriers - Valves (BWR, in Lines for Emergency Core Cooling Systems, Feedwater, Main Steam)

C.8.1 Body

C.8.2 Bonnet

C.9 Isolation Barriers - Valves (PWR, in Lines for Emergency Core Cooling Systems, Feedwater, Auxiliary Feedwater, Main Steam, and Blowdown Piping)

C.9.1 Body

C.9.2 Bonnet

C.10 Isolation Barriers - Valves (BWR & PWR, in Lines for Fire Protection, Plant Heating, Waste Gas, Plant Drain, Liquid Waste, & Cooling Water)

C.10.1 Body

C.10.2 Bonnet

C. Containment Isolation Components

System, Structures, and Components

The system, structures, and components included in this table comprise the containment isolation components found in all designs of boiling water reactors (BWR) and pressurized water reactors (PWR) in the U.S. BWR and PWR components are treated separately in the table where differences in the operating environments may influence their degradation behavior. The system consists of personnel and equipment hatches; mechanical, electrical, fuel transfer, and leak-testing penetrations; purges and vents; and BWR and PWR isolation barriers valves. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the containment isolation components are classified as Group A or B Quality Standards.

System Interfaces

All of the systems that penetrate the containment pressure boundary interface with the containment isolation components.

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.1.1 thru C.1.3	Personnel Hatch	Hatchway, Inner Door, Outer Door	Carbon steel (Coating)	Air; Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Loss of Material	General Corrosion	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4. *Operating Experience* NRC IN 89-79.

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Implementation of periodic inspections of containment structures in accordance with ASME Section XI, Subsection IWE; in conjunction with a coatings program in accordance with ANSI 101.2, ANSI 101.4, and Regulatory Guide 1.54; and the containment leak rate test requirements of Appendix J of 10 CFR Part 50, provide assurance that the containment steel components will continue to perform their intended function during the extended period. Inspection requirements of Subsection IWE include examination categories E-A for containment surfaces, E-C for containment surfaces requiring augmented inspection, E-D for seals, gaskets, and moisture barriers, E-G for pressure retaining bolting, and E-P for all pressure retaining components. The coatings program includes qualification of Service Level I coatings, guidance for coating selection and procurement, specifications of surface preparation and coating application, and inspection requirements and criteria. The leak rate tests verify the leak-tight integrity of the containment pressure boundary. Type A (integrated) tests measure the overall leakage rate of the containment, and Type B (local) tests measure leakage of containment penetrations whose design incorporates resilient seals and gaskets including airlock door seals and equipment hatch gaskets.	***(1) Scope of Program:*** The program relies on periodic inspections to detect degradation of the containment steel components, periodic assessment of existing coatings, and leak-rate testing to manage leak-tight integrity of the containment pressure boundary. ***(2) Preventive Actions:*** An effective implementation of containment coating program assures that the essential leak-tight barriers of the containment steel structures will be protected from the environmental effects. ***(3) Parameters Monitored/ Inspected:*** Periodic inspection in accordance with ASME Section XI, Subsection IWE monitors integrity of the coating, loss of material from corrosion, expansion joint sealant integrity, and seal integrity of the liner behind the attachment welds. Coatings program monitors application of the coatings including surface preparation, dry film thickness, and visual inspection of the coating for damage. Periodic assessment of the coatings include the visual appearance and presence of corrosion products. ***(4) Detection of Aging Effects:*** Effects of aging for coatings include rusted areas, flaking, blistering, crazing, peeling, discoloration, and other signs of damage to accessible metal surface coatings. The visual inspections are supplemented by remote inspections to provide access to otherwise inaccessible areas. Implementation of Subsection IWE, supplemented by the additional requirements of 10 CFR 50.55a, assures detection of significant aging effects by visual inspection. Significant reduction in thickness of the leak-tight barrier requires thickness measurements by volumetric examination. ***(5) Monitoring and Trending:*** A visual examination of the containment pressure retaining boundary is suggested prior to each leakage rate test under 10 CFR 50.55a. The periodic assessments of coatings are conducted during each refueling outage. ***(6) Acceptance Criteria:*** Any significant degradation is reported and evaluated in accordance with ASME Subsection IWE-3500. Acceptance criteria for coatings are stated in ANSI 101.2 and 101.4. ***(7, 8 & 9) Corrective Actions, Confirmation Process and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Severe degradation of coatings and the corrosion of steel ice condenser containment vessels have been reported for the McGuire 1 containment. The corrosion was caused by boric acid and collected condensation in the annular space between the steel shell and the surrounding concrete shield, coating damage and base. Metal corrosion was also detected during inspections of the steel shells of the containment at Catawba (NRC IN 89-79).	No

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.1.1 thru C.1.3	Personnel Hatch	Hatchway, Inner Door, Outer Door	Carbon steel (Coating)	Air: Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Attrition, Loss of Material	Wear VC-1	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4.
C.2.1, C.2.2	Equipment Hatch	Hatchway, Cover Plate	Carbon steel (Coating)	Air: Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Loss of Material	General Corrosion	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4.
C.2.1, C.2.2	Equipment Hatch	Hatchway, Cover Plate	Carbon steel (Coating)	Air: Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Attrition, Loss of Material	Wear VC-1	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4.
C.3.1, C.3.3, C.3.4, C.3.5	Mechanical (pipe) Penetrations	Sleeve, Closure Plate, Anchors, Fasteners,	Carbon Steel (typically A516, Gr 70)	Air: Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Loss of Material	General Corrosion	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4.
C.3.2	Mechanical (pipe) Penetrations	Seal	Elastomers	Internal: Occasional Moist Air; External: Ambient Air	Changes in Hardness, Compression Strength, and other Physical Properties	Elastomer Degradation	ASME Code Section XI, 1992 Edition. 10 CFR 50, Appendices B & J.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).	*Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).*	No
Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).	*Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).*	No
Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).	*Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).*	No
Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).	*Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).*	No
Elastomeric components have been designed and evaluated for specific lifetimes within the initial 40-year licensing period under 10 CFR 50, Appendix B. A similar evaluation is needed for the additional license renewal time period. During the initial 40-year licensing period, the aging management program consists of periodic visual inspections and pressure leakage rate tests in accordance with ASME Section XI, Subsection IWE. A visual examination of the containment vessel pressure retaining boundary is required prior to each 10 CFR 50, Appendix J, Type A leakage rate test.	***(1) Scope of Program:*** he program relies on periodic inspections to detect degradation of the containment isolation components and leak-rate testing to manage leak-tight integrity of the containment pressure boundary. ***(2) Preventive Actions:*** The program does not address prevention of component degradation, but instead focuses on its timely detection. Preventative actions are provided by routine plant-specific maintenance procedures. ***(3) Parameters Monitored/ Inspected:*** Periodic inspection in accordance with ASME Section XI, Subsection IWE monitors seal integrity of isolation components and leak rate tests verify the leak-tight integrity of the containment pressure boundary. ***(4) Detection of Aging Effects:*** Pressure and leakage rate tests detect the presence of leaks through the containment boundary components, including the elastomer seals. ***(5) Monitoring and Trending:*** A visual examination of the containment vessel pressure retaining boundary is required prior to each leakage rate test. ***(6) Acceptance Criteria:*** Any significant degradation is reported and required further evaluation in accordance	No

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.4.1, C.4.2, C.4.4	Electrical Penetrations	Sleeve Header Plate Anchors	Carbon Steel (typically A516, Gr 70)	Air; Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Loss of Material	General Corrosion	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4.
C.4.3	Electrical Penetrations	Seal	Elastomers	Air; Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Changes in Hardness, Compression Strength, & Physical Properties	Elastomer Degradation	ASME Code Section XI, 1992 Edition. 10 CFR 50, Appendices B and J.
C.5.1 thru C.5.3	Fuel Transfer Penetrations	Sleeve, Closure Plate, Anchors	Carbon Steel (typically A516, Gr 70) SEE VC-3	Air; Occasional Leaking Borated Water	Loss of Material	General Corrosion SEE VC-3	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4.
C.6.1	Purge/Vent	Seal	Elastomers; Nitrile, Ethylene Propylene	Air; Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Changes in Hardness, Compression Strength, & Physical Properties	Elastomer Degradation	ASME Code Section XI, 1992 Edition. 10 CFR 50, Appendices B and J.
C.7.1 C.7.2	Leak Testing Penetration	Mechanical Penetrations, Sleeves	Carbon Steel (typically A516, Gr 70)	Air; Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Loss of Material	General Corrosion	ASME Code Section XI, 1992 Edition. 10 CFR 50 Appendix J. Regulatory Guide 1.54. ANSI 101.2. ANSI 101.4.

V ENGINEERED SAFETY FEATURES
C. CONTAINMENT ISOLATION COMPONENTS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) with ASME Subsection IWE-3500. ***(7, 8 & 9) Corrective Actions, Confirmation Process and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** No significant failure problems reported.	
Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).	*Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).*	No
Same as for the effect of elastomer degradation on Item C.3.2 mechanical (pipe) penetration seals. In addition, elastomeric materials for electrical components are required to meet the requirements of 10 CFR 50.49.	*Same as for the effect of elastomer degradation on Item C.3.2 mechanical (pipe) penetration seals.*	No
Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).	*Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).*	No
Same as for the effect of elastomer degradation on Item C.3.2 mechanical (pipe) penetration seals.	*Same as for the effect of elastomer degradation on Item C.3.2 mechanical (pipe) penetration seals.*	No
Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).	*Same as for the effect of General Corrosion on personnel hatch hatchway (C.1.1), inner door (C.1.2), and outer door (C.1.3).*	No

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.7.3	Leak Testing Penetration	Seal	Elastomers: Nitrile, Ethylene Propylene	Air; Occasional Leaking Borated Water (PWRs) or Oxygenated Water (BWRs)	Changes in Hardness, Compression Strength, & Physical Properties	Elastomer Degradation	ASME Code Section XI, 1992 Edition. 10 CFR 50, Appendices B and J.
C.8.1, C.8.2	BWR Isolation Barriers—Valves (in Lines for Emergency Core Cooling Systems, Feedwater, Main Steam).	Body, Bonnet	Carbon Steel, Low-Alloy Steel	Inside Surface: Chemically Treated Oxygenated Water or Steam up to 288°C; Outside Surface: Air	Loss of Material	General, Crevice, and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Appendix I and Subsection ISTC. 10 CFR 50 Appendix J. EPRI TR-103515. NRC GL 89-04. NRC GL 90-06. NRC GL 96-05. NRC IN 88-70. Plant Technical Specifications.

SEE VC-7

SEE VC-7 VC-8

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for the effect of elastomer degradation on Item C.3.2 mechanical (pipe) penetration seals.	*Same as for the effect of elastomer degradation on Item C.3.2 mechanical (pipe) penetration seals.*	No
Water chemistry program based on EPRI guidelines of TR-103515 and implemented through the plant technical specifications for minimizing impurities by monitoring and maintaining water chemistry conditions; inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, testing category B-P for pressure retaining Class 1 components; and Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 1 and 2 valves, additional staff guidelines of NRC Generic Letter (GL) 89-04 regarding the scope of inservice testing (IST), and information in NRC IN 88-70 regarding scope and testing of safety-related check valves, and in GL 96-05 regarding safety-related motor-operated valves, IST is performed in accordance with ASME Subsection IWV (Operation and Maintenance Code Appendix I and Subsection ISTC), to ensure that the changes in design-basis performance of safety-related valves resulting from degradation can be identified and managed. Also, the integrity of the containment isolations valves is verified in Type C leak rate tests in accordance with Appendix J of 10 CFR 50.	~~***(1) Scope of Program:*** The program relies on preventive~~ measures to mitigate crevice or pitting corrosion and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Mitigation is by monitoring and control of water chemistry to minimize concentration of corrosive impurities by following EPRI guidelines of TR-103515 and implemented through the plant technical specifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 1 components according to Table IWB 2500-1 category B-P; and pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1 and 2 valves and additional guidelines of NRC GLs 89-04 and 96-05, IST is performed in accordance with ASME Subsection IWV (OM Code Appendix I and Subsection ISTC). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant or degradation of component performance. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. ***(5) Monitoring and Trending:*** ISI/IST schedule of ASME Section XI should provide for timely detection of corrosion. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWC-3516 for Class 2 components. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Prior to service.	Yes, Element 4 should be further evaluated

SEE VC-6

CHEMISTRY CONTROL PROGRAM AND ISI PROGRAM FOR EXTERNAL SURFACES VC-11.

(SEE CHAPTER XI #11)

SEE CHAPTER XI FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM AND THE ISI PROGRAM FOR EXTERNAL SURFACES.

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.8.1 C.8.2	BWR Isolation Barriers—Valves (in Lines for Emergency Core Cooling Systems, Feedwater, Main Steam).	Body, Bonnet	Carbon Steel, Low-Alloy Steel	Inside Surface: Chemically Treated Oxygenated Water or Steam up to 288°C; Outside Surface: Air	Crack Initiation and Growth	SCC	NUREG-0313, Rev. 2. NRC GL 88-01. ASME Section XI, 1989 Edition. 10 CFR 50 Appendix J. BWRVIP-29. EPRI TR-103515.

JEE VC-4

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair is in conformance with IWA-4000 and replacement according to IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at crevice geometry where buildup of [redacted]	
Program delineated in NUREG-0313, Rev. 2 and implemented through NRC Generic letter (GL) 88-01, and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, examination categories B-M-1 and B-M-2 for Class 1 valves; Table IWC 2500-1, examination category C-G for pressure retaining welds in Class 2 valves. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in TR-103515 and BWRVIP-29 to minimize the potential of crack initiation and growth. Also, the integrity of the containment isolations valves is verified in Type C leak rate tests in accordance with Appendix J of 10 CFR 50. SEE VC-9	***(1) Scope of Program:*** The program includes implementing counter measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and combination of inservice inspection (ISI) to monitor SCC and its effects on the intended function of valves. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding mitigating IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of cast SSs and weld metal, with a maximum carbon of 0.035% and minimum 7.5% ferrite. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors SCC of valves by detection and sizing of cracks by implementing the inspection schedule, methods, personnel, sample expansion, and leak detection requirements of GL 88-01. In a group of multiple valves of similar design, size, function, and service in a system, examination of only one valve is required. Coolant water chemistry is monitored and maintained in accordance with the EPRI guidelines in BWRVIP-29 to minimize the potential of crack initiation and growth. ***(4) Detection of Aging Effects:*** Degradation of valves due to SCC can not occur without crack initiation and growth; ISI schedule delineated in the AMP is adequate and will assure detection of cracks or degradation of valve performance before the loss of intended function of valves. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with GL 88-01 should provide timely detection of cracks. All welds are inspected each inspection period from at least one valve in each group with similar design and performing similar functions in the system. Visual examination is performed only when the valve is disassembled for maintenance, repair, or volumetric examination, but at least once during the period. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3515. ***(7) Corrective Actions:*** Repair is in conformance with IWA-4000 and replacement is in accordance with IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** The	No

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.9.1, C.9.2	PWR Isolation Barriers—Valves (in Lines for Emergency Core Cooling Systems, Feedwater, Auxiliary Feedwater, Main Steam, and Blowdown Piping).	Body, Bonnet	Carbon Steel, Low-Alloy, Steel	Inside Surface: Chemically Treated Borated Water or Steam up to 340°C; Outside Surface: Air	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Appendix I and Subsection ISTC. 10 CFR 50 Appendix J. NRC GL 89-04. NRC GL 96-05. NRC IN 88-70. EPRI TR-105714. Plant Technical Specifications. *Operating Experience* NRC IN 84-18. NRC IN 98-23. NRC IN 94-63.

SEE VC-4

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) comprehensive AMP outlined in GL 88-01 addresses improvements in all three elements that cause SCC, e.g., a susceptible material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring structural integrity of BWR components.	
Inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, testing category B-P for pressure retaining Class 1 components; and Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 1 and 2 valves, additional staff guidelines of NRC Generic Letter (GL) 89-04 regarding the scope of inservice testing (IST), and information in NRC IN 88-70 regarding scope and testing of safety-related check valves, and in GL 96-05 regarding safety-related motor-operated valves. IST is performed in accordance with ASME Subsection IWV (Operation and Maintenance Code Appendix I and Subsection ISTC), to ensure that the changes in design-basis performance of safety-related valves resulting from degradation can be identified and managed. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry. Also, the integrity of the containment isolations valves is verified in Type C leak rate tests in accordance with Appendix J of 10 CFR 50.	~~*(1) Scope of Program:* The program relies on~~ preventive measures to mitigate crevice or pitting corrosion and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of corrosion. However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool [NRC Information Notice (IN) 84–18], or from water from the sump. The aging management program must therefore rely upon inservice inspections in accordance with ASME Section XI to detect possible degradation. ~~*(3) Parameters Monitored/ Inspected:* The AMP monitors~~ the effects of corrosion by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 1 components according to Table IWB 2500-1 category B-P; and pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1 and 2 valves and additional guidelines of NRC GLs 89-04 and 96-05, IST is performed in accordance with ASME Subsection IWV (OM Code Appendix I and Subsection ISTC). ***(4) Detection of ~~Aging Effects:~~*** Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the	~~Yes, Element 4 should be further evaluated~~ NO

CHEMISTRY CONTROL PROGRAM AND ISI PROGRAM FOR EXTERNAL SURFACES

VC-11 (SEE #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR CHEM. CONTROL PROGRAM AND THE ISI PROGRAM FOR EXTERNAL SURFACES.

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.9.1, C.9.2	PWR Isolation Barriers—Valves (in Lines for Emergency Core Cooling Systems, Feedwater, Auxiliary Feedwater, Main Steam, and Blowdown Piping).	Body, Bonnet	SS Forging SS Casting	Inside Surface: Chemically Treated Borated Water or Steam up to 340°C; Outside Surface: Air	Crack Initiation and Growth	SCC	ASME Section XI, 1989 Edition. NRC Reg. Guide 1.44. 10 CFR 50 Appendix J. EPRI TR-105714 Plant Technical Specifications. *Operating Experience* NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19.

SEE VC-4

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWB-3100 and acceptance standards of IWB-3400 and IWB-3522 for Class 1 components, IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components, IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Corrosion has been observed in guide rings of relief valves (IN 98-23) and charging pump casing (IN 94-63).	
Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, examination categories B-M-1 and B-M-2 for Class 1 valves; Table IWC 2500-1, examination category C-G for pressure retaining welds in Class 2 valves. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry. Also, the integrity of the containment isolations valves is verified in Type C leak rate tests in accordance with Appendix J of 10 CFR 50.	***(1) Scope of Program:*** The program includes preventive measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Selection of material in compliance with the requirements of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool [NRC Information Notice (IN) 84-18], or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on intended function of the valves by detection and sizing of cracks by ISI. Inspection requirements of Table IWB 2500-1 for Class 1 valves, examination category B-M-1 specify for all welds NPS 4 or larger, volumetric examination extending 1/2 in. on either side of the weld and through wall thickness, and for welds less than NPS 4, surface examination of OD surface extending 1/2 in. on either side of the weld. Category B-M-2 specifies visual VT-3 examination of internal surfaces of the valve. Table IWC 2500-1 for Class 2 valves, category C-G specifies for all valves in each piping run examined under category C-F, surface examination of either the inside or outside surface of all welds extending 1/2 in. on either side of the weld. In a group of multiple valves of similar design, size, function, and service in a system, examination of only one valve is required. ***(4) Detection of Aging Effects:*** Degradation of valves due to SCC can not occur without crack initiation and growth; ISI schedule assures detection of cracks or	No

V ENGINEERED SAFETY FEATURES

C. CONTAINMENT ISOLATION COMPONENTS

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.9.1, C.9.2	PWR Isolation Barriers—Valves (in Lines for Emergency Core Cooling Systems, Feedwater, Auxiliary Feedwater, Main Steam, and Blowdown Piping).	Body, Bonnet (External Surfaces)	Carbon Steel, Low-Alloy, Steel	Air, Leaking Chemically Treated Borated Water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications. *Operating Experience* NRC IN 86-108 S3.

SEE VC-4

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) initiation and growth; ISI schedule assures detection of cracks or degradation of valve performance before the loss of intended function of the valves. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWB-2400 or IWC-2400 should provide timely detection of cracks. All welds are inspected each inspection period from at least one valve in each group with similar design and performing similar functions in the system. Visual examination is required only when the valve is disassembled for maintenance, repair, or volumetric examination, but at least once during the period. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWB-3400 and IWB-3518 for volumetric and surface examination of welds or IWB-3519 for visual examination of valve internal surfaces and IWC-3400 and IWC-3515 for surface examination of welds in Class 2 valves. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels and control of primary water chemistry, significant potential of SCC exists from inadvertent introduction of contaminants into the primary coolant system (IN 84-18). SCC has been observed in safety injection lines (IN 97-19 and 84-18), charging pump casing cladding (INs 80-38 and 94-63), and instrument nozzles in safety injection tanks (IN 91-05).	
Implementation of NRC Generic Letter 88-05 and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, testing category B-P for pressure retaining Class 1 components, e.g., CFS and other components within the containment; Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components, e.g., most components in the safety injection system; and Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling.	***(1) Scope of Program:*** The staff guidance of Generic Letter (GL) 88-05 provides assurances that a program has been implemented consisting of systematic measures to ensure that the effects of corrosion caused by leaking coolant containing boric acid does not lead to degradation and provides assurance that the reactor coolant pressure boundary will have a extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture. The program includes (a) determination of principal location, (b) examinations requirements and procedures for locating small leaks, and (c) engineering evaluations and corrective actions. ***(2) Preventive Actions:*** Minimizing reactor coolant leakage by frequent monitoring of the locations where potential leakage could occur and repairing the leaky components as soon as possible, prevent or mitigate boric acid corrosion. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of boric acid corrosion on the intended function of the component by detection of coolant leakage by implementing the program delineated in GL 88-05 including guidelines for locating small leaks, conducting examinations, and performing engineering evaluations. Inspection requirements of ASME Section XI specify	No

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.10.1, C.10.2	BWR and PWR Isolation Barriers—Valves (in Lines for Fire Protection, Plant Heating, Waste Gas, Plant Drain, Liquid Waste, & Cooling Water).	Body, Bonnet	Carbon Steel, Low-Alloy Steel, and Stainless Steel	Inside Surface: Treated or Raw Water, Gaseous or Liquid Waste, Reactor Coolant; Outside Surface: Ambient Air	Loss of Material	General, Pitting, and Crevice Corrosion MIC VC-2	Plant Technical Specifications.

SEE VC-4
SEE VC-5
SEE VC-10

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 1 components extending to and including the second closed valve at the boundary extremity, according to Table IWB 2500-1 category B-P; pressure retaining Class 2 components required to operate or support the safety function up to and including the first normally closed valve, according to Table IWC 2500-1 category C-H; and Class 3 components in support of emergency core cooling, containment heat removal, and reactor residual heat removal, according to Table IWD 2500-1 category D-B. ***(4) Detection of Aging Effects:*** Degradation of the component due to boric acid wastage can not occur without leakage of coolant containing boric acid; extent and schedule of the program delineated in GL 88-05 will assure detection of leakage before the loss of intended function of the component. ***(5) Monitoring and Trending:*** The program delineated in GL 88-05 provides for timely detection of leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any coolant leakage is evaluated in accordance with the program proposed by GL 88-05. ***(7) Corrective Actions:*** The leakage source and areas of general corrosion are located and corrective actions are in conformance with the program proposed by GL 88-05, and the requirements of ASME Section XI, IWB-3142 and IWA-5250. Components with local areas of corrosion that reduces the wall thickness by more than 10% require analytical evaluation to demonstrate acceptability. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Boric acid wastage observed in nuclear power plants may be classified into two distinct types: (a) corrosion that increases the rate of leakage, e.g., corrosion of closure bolting or fasteners in reactor coolant pressure boundary, and (b) corrosion that occurs some distance from the source of leakage. Some recent incidents of boric acid wastage (IN 86-108 S3) indicate that, although implementation of GL 88-05 ensures timely detection of leakage, there may still be a lack of awareness of the conditions that can lead to boric acid wastage.	
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, no AMP

D1 Emergency Core Cooling System (Pressurized Water Reactor)

- D1.1 Piping & Fittings
  - D1.1.1 Core Flood System (CFS)
  - D1.1.2 Residual Heat Removal (RHR) or Shutdown Cooling (SDC)
  - D1.1.3 High Pressure Safety Injection (HPSI)
  - D1.1.4 Low Pressure Safety Injection (LPSI)
  - D1.1.5 Connecting lines to Chemical & Volume Control System (CVCS) & Spent Fuel Pool (SFP) Cooling
  - D1.1.6 Lines to Emergency Sump
  - D1.1.7 Bolting for Flange Connections
- D1.2 HPSI & LPSI Pumps
  - D1.2.1 Bowl/Casing
  - D1.2.2 Bolting
- D1.3 RWT Circulation Pump
  - D1.3.1 Bowl/Casing
  - D1.3.2 Bolting
- D1.4 Valves
  - D1.4.1 Body and Bonnet
  - D1.4.2 Bolting
- D1.5 Heat Exchangers (RCP, HPSI, & LPSI Pump Seals; & RHR)
  - D1.5.1 Bonnet/Cover
  - D1.5.2 Tubing
  - D1.5.3 Shell
  - D1.5.4 Case/Cover
  - D1.5.5 Bolting

D1.6 Heat Exchangers (RWT Heating)

D1.6.1 Bonnet/Cover

D1.6.2 Tubing

D1.6.3 Shell

D1.6.4 Bolting

D1.7 Safety Injection Tank (Accumulator)

D1.7.1 Shell

D1.7.2 Manway

D1.7.3 Penetrations/Nozzles

D1.8 Refueling Water Tank (RWT)

D1.8.1 Shell

D1.8.2 Manhole

D1.8.3 Penetrations/Nozzles

D1.8.4 Bolting

D1.8.5 Perimeter Seal

D1. Emergency Core Cooling System (Pressurized Water Reactors)

System, Structures, and Components

The system, structures, and components included in this table comprise 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, and consist of the core flood system (CFS), residual heat removal (RHR) or shutdown cooling (SDC), high-pressure safety injection (HPSI) system, low-pressure safety injection (LPSI) system, lines to chemical and volume control system (CVCS), spent fuel pool (SFP) cooling, and emergency sump, and HPSI and LPSI pumps, pump seal coolers, RHR heat exchanger, and refueling water tank (RWT). Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the emergency core cooling system are classified as Group B Quality Standards. Portion of the RHR, HPSI, LPSI systems and CVCS extending from the reactor coolant system up to the second isolation valve outside the containment are classified as Group A and covered in Table IV C2. The aging management program for the variety of lines that penetrate the containment and associated isolation valves is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the emergency core cooling system include the reactor coolant system (Table IV C2), containment spray system (Table V A), spent fuel pool cooling and cleanup (Table VII A3), closed cycle cooling water (Table VII C2), chemical and volume control system (Table VII E1), and coolant storage/refueling water system (Table VII E4).

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.1.1 thru D1.1.6	Piping & Fittings	Core Flood System (CFS), Residual Heat Removal (RHR), High-Pressure Safety Injection (HPSI), Low-Pressure Safety Injection (LPSI), Connecting lines to Chemical & Volume Control System (CVCS) and Spent Fuel Pool (SFP) Cooling, Lines to Emergency Sump	Stainless Steel (SS)	25-340°C, chemically treated borated water	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	~~ASME Section XI, 1989 Edition.~~ Regulatory Guide ~~1.44.~~ 1.43 EPRI TR-105714. Plant Technical Specifications. *Operating Experience* NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19.

SEE VD1-5

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Guidelines of Regulatory Guide (RG) 1.44~~ to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, examination category B-J for pressure retaining welds in Class 1 piping, e.g., CFS and other components within the containment; Table IWC 2500-1, examination category C-F-1 for pressure retaining welds in Class 2 SS piping, e.g., most of the safety injection piping; and Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling, e.g., refueling water tank (RWT) heating system. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry and plant technical specifications for refueling water storage tank water chemistry.	~~(1) Scope of Program: The program includes preventive~~ measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of emergency core cooling system piping and fittings. ***(2) Preventive Actions:*** Selection of material in compliance with the guidelines of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. ~~However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 84-18), or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation.~~ ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on intended function of the piping by control of system water chemistry and by detection and sizing of cracks by ISI. Inspection requirements of IWB 2500-1 category B-J or IWC 2500-1 category C-F-1, specify for circumferential and longitudinal welds in each pipe or branch run NPS 4 or larger, volumetric and surface examination of ID region extending 1/4 in. on either side of the weld and 1/3 wall thickness deep, and surface examination of OD surface extending 1/2 in. on either side. Surface examination is conducted for circumferential and longitudinal welds in each pipe of ~~[illegible]~~ surface examination is specified of OD surface extending 1 in. on the buttered side and 1/2 in. on the other. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment ~~is in conformance with Appendices VII and VIII of ASME Section XI, or any other formal program approved by the NRC.~~ ***(4) Detection of Aging Effects:*** Degradation of piping and fittings due to SCC can not occur without crack initiation; inspection schedule assures detection of cracks before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWB-2400, IWC-2400, or IWD-2400 for Class 1, 2, or 3 piping, respectively, ~~would provide timely detection of cracking. System leakage~~ test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWB-3100 by comparing ISI results with the acceptance standards of IWB-3400 and IWB-3514 or IWC-3400 and IWC-3514. Plant and liner flaws are sized according to IWA-3300 and IWA-3400. Supplementary surface examination may be performed on interior and/or exterior surfaces when flaws are detected in volumetric examination. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000, and reexamination in accordance with	No

CHEMISTRY CONTROL PROGRAM (SEE CHAPTER XI #11) VD1-1

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR CHEM. CONTROL PROGRAM

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.1.1 thru D1.1.5	Piping & Fittings	CFS, RHR or SDC, HPSI, LPSI, Lines to CVCS & SFP cooling	SS	25-340°C, chemically treated borated water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ EPRI TR-105714. Plant Technical Specifications. *Operating Experience* NRC IN 84-18.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) of IWA-2200. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels and control of primary water chemistry, potential of SCC exists from inadvertent introduction of contaminants into the primary coolant system (IN 84–18). SCC has been observed in safety injection lines (IN 97-19 and 84-18), charging pump casing cladding (INs 80-38 and 94-63), and instrument nozzles in safety injection tanks (IN 91-05).	
Inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, testing category B-P for pressure retaining Class 1 components, e.g., CFS and other components within the containment; Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components, e.g., most components in the safety injection system; and Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling, e.g., refueling water tank (RWT) heating system. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry and plant technical specifications for refueling water storage tank water chemistry.	~~***(1) Scope of Program:***~~ measures to mitigate crevice or pitting corrosion and inservice inspection (ISI) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down. However, inadvertent introduction of contaminants into the coolant system can occur either e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool [NRC Information Notice (IN) 84–18], or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by control of system water chemistry and by detection of coolant leakage by inservice inspection (ISI). Inspection requirements ~~of ASME Section XI~~ specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 1 components according to Table IWB 2500-1 category B-P; Class 2 components required to operate or support the safety function according to Table IWC 2500-1 category C-H; and Class 3 components in support of emergency core cooling according to Table IWD 2500-1 category D-B. ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be ~~examined~~ to ensure that ~~significant~~ degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic.	~~Yes, Element 4 should be further evaluated~~ NO

CHEMISTRY CONTROL PROGRAM D1-1

(SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.1.1 thru D1.1.4	Piping & Fittings	CFS, RHR or SDC, HPSI, LPSI	SS	25-340°C, chemically treated borated water	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
D1.1.6	Piping & Fittings	Lines to Emergency Sump	SS	Stagnant chemically treated borated water	Loss of Material	Microbio-logically Induced Corrosion (MIC)	–
D1.1.7	Piping & Fittings	Bolting for flange connections in Items D1.1.1 thru D1.1.5	Nuts: Carbon Steel (CS), Bolts/Studs Alloy steel	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications. *Operating Experience* NRC IN 86-108 S3.

JEE VD1-4

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWB-3100 and acceptance standards of IWB-3400 and IWB-3522 for Class 1 components, IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components, IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at mechanical joints, e.g., flange connections, because they present a crevice geometry at the sealing surfaces that may allow buildup of impurities due to stagnant conditions.	
Components have been designed for fatigue for a 40 y design life according to the requirements of ANSI B31.1.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, check Code limits for allowable cycles (less than 7000 cycles) of thermal stress range.	Yes TLAA
Plant-specific aging management program.	Plant-specific aging management program will be evaluated.	Yes no AMP
Implementation of NRC Generic Letter 88-05 and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, testing category B-P for pressure retaining Class 1 components, e.g., CFS and other components within the containment; Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components, e.g., most components in the safety injection system; and Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling.	***(1) Scope of Program:*** The staff guidance of Generic Letter (GL) 88-05 provides assurances that a program has been implemented consisting of systematic measures to ensure that the effects of corrosion caused by leaking ~~coolant~~ containing boric acid does not lead to degradation and provides assurance that the reactor ~~coolant pressure boundary~~ will have a extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture. The program includes (a) determination of principal location, (b) examinations requirements and procedures for locating small leaks, and (c) engineering evaluations and corrective actions. ***(2) Preventive Actions:*** Minimizing ~~reactor coolant~~ leakage by frequent monitoring of the locations where potential leakage could occur and repairing the leaky components as soon as possible, prevent or mitigate boric acid corrosion. ***(3) Parameters Monitored/Inspected:*** The AMP	No BOLTING FLUID FLUID VD1-3

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

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

V D1-3 FLW10

V ENGINEERED SAFETY FEATURES
D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) monitors the effects of boric acid corrosion on the intended function of the component by detection of ~~coolant~~ leakage by implementing the program delineated in GL 88-05 including guidelines for locating small leaks, conducting examinations, and performing engineering evaluations. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 1 components extending to and including the second closed valve at the boundary extremity, according to Table IWB 2500-1 category B-P; pressure retaining Class 2 components required to operate or support the safety function up to and including the first normally closed valve, according to Table IWC 2500-1 category C-H; and Class 3 components in support of emergency core cooling, containment heat removal, and reactor residual heat removal, according to Table IWD 2500-1 category D-B. ***(4) Detection of Aging Effects:*** Degradation of the component due to boric acid wastage can not occur without leakage of coolant containing boric acid; extent and schedule of the program delineated in GL 88-05 will assure detection of leakage before the loss of intended function of the component. ***(5) Monitoring and Trending:*** The program delineated in GL 88-05 provides for timely detection of leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any coolant leakage is evaluated in accordance with the program proposed by GL 88-05. ***(7) Corrective Actions:*** The leakage source and areas of general corrosion are located and corrective actions are in conformance with the program proposed by GL 88-05, and the requirements of ASME Section XI, IWB-3142 and IWA-5250. Components with local areas of corrosion that reduces the wall thickness by more than 10% require analytical evaluation to demonstrate acceptability. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Boric acid wastage observed in nuclear power plants may be classified into two distinct types: (a) corrosion that increases the rate of leakage, e.g., corrosion of closure bolting or fasteners in reactor coolant pressure boundary, and (b) corrosion that occurs some distance from the source of leakage. Some recent incidents of boric acid wastage (IN 86-108 S3) indicate that, although implementation of GL 88-05 ensures timely detection of leakage, there may still be a lack of awareness of the conditions that can lead to boric acid wastage.	

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.2.1	HPSI & LPSI Pumps	Bowl/Casing	SS, CS with SS cladding	25-340°C, chemically treated borated water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ ASME OM Code-1990, Subsection ISTB. ~~NRC GL 89-04~~ EPRI TR-105714. Plant Technical Specifications. *Operating Experience* NRC IN 84-18.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components, e.g., most components in the safety injection system; and Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling, e.g., refueling water tank (RWT) heating system; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 pumps and valves, and additional NRC staff guidelines of NRC Generic Letter 89-04, inservice testing performed in accordance with ASME Subsection IWP (or Operation and Maintenance Code Subsection ISTB) for pumps, or other approved program in the plant specifications. Water chemistry program based on EPRI guidelines of TR-105714 for minimizing impurities by monitoring and maintaining primary water chemistry.	~~*(1) Scope of Program:*~~ The program relies on preventive measures to mitigate crevice or pitting corrosion and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down mitigate potential of corrosion. ~~However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice (IN) 84-18), or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation.~~ ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by control of water chemistry and by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements ~~of ASME Section XI~~ specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 2 components required to operate or support the safety function according to Table IWC 2500-1 category C-H, and Class 3 components in support of emergency core cooling according to Table IWD 2500-1 category D-B. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 pumps and valves and additional guidelines of NRC Generic Letter (GL) 89-04, IST is performed in accordance with ASME Subsection IWP (or OM Code Subsection ISTB). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWB-3100 and acceptance standards of IWB-3400 and IWB-3522 for Class 1 components, IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components, IWD-3000 for Class 3	~~Yes, Element 4 should be further evaluated~~ NO

CHEMISTRY CONTROL PROGRAM VD1-1 (SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.2.1	HPSI & LPSI Pumps	Bowl/Casing	SS, CS with SS cladding	25-340°C, chemically treated borated water	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	~~ASME Section XI, 1989 Edition~~ Regulatory Guide ~~1.44~~ 1.43 EPRI TR-105714. Plant Technical Specifications. *Operating Experience* NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at flange connections where buildup of impurities can occur.	
Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-G for pressure retaining welds in pumps. Water chemistry program based on EPRI guidelines of TR-105714 for minimizing impurities by monitoring and maintaining primary water chemistry.	~~(1) Scope of Program:~~ The program includes preventive measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Selection of material in compliance with the requirements of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool (NRC Information Notice IN 84-18), or from water from the sump. The AMP must therefore rely upon ISI ~~in accordance with ASME Section XI~~ to detect possible degradation. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of SCC on intended function of the pump by control of primary water chemistry and by detection and sizing of cracks by ISI. Inspection requirements of IWC 2500-1 category C-G, specifies surface examination of either the inside or outside surface of all welds extending 1/2 in. on either side of the weld. In a group of multiple pumps of similar design, size, function, and service in a system, examination of only one pump is required. ***(4) Detection of Aging Effects:*** Degradation of pumps due to SCC can not occur without crack initiation and growth; ISI schedule assures detection of cracks or degradation of pump performance before the loss of intended function of the pump. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWC-2400 should provide timely detection of cracks. Surface examination of welds is conducted during each inspection interval. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3515. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000, and reexamination in accordance with requirements of IWA-2200. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to	No

CHEMISTRY CONTROL PROGRAM VD1-1 (SEE CHAPTER XI #11)

SEE CHAPTER XI FOR EVALUATION AND TECHNICAL BASIS FOR

CHEM. CONTROL PROGRAM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.2.1, D1.2.2	HPSI & LPSI Pumps	Bowl/Casing (External Surfaces), Bolting	Casing: CS; Nuts: CS, Bolts/Studs: Alloy Steel	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications.
D1.3.1	RWT Circulation Pump	Bowl/Casing	SS	25°C chemically treated borated water	Loss of Material	Crevice and Pitting Corrosion	*Same as effect of Crevice and Pitting Corrosion of Item D1.2.1 bowl/casing for HPSI and LPSI pumps*
D1.3.2	RWT Circulation Pump	Bolting	Nuts: CS, Bolts/Studs: Alloy Steel	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications.
D1.4.1	Valves (Check, Control, Hand, Motor Operated, and Relief Valves)	Body and Bonnet	SS, CS with SS cladding	25–340°C, chemically treated borated water	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
D1.4.1	Valves (Check, Control, Hand, Motor Operated, and Relief Valves)	Body and Bonnet	SS, CS with SS cladding	25–340°C, chemically treated borated water	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Appendix I and Subsection ISTC. NRC GL 89-04. NRC GL 96-05. NRC IN 88-70. EPRI TR-105714. Plant Technical Specifications. *Operating Experience* NRC IN 84-18. NRC IN 98-23. NRC IN 94-63.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels, potential of SCC exists from inadvertent introduction of contaminants into the primary coolant system (IN 84-18). SCC has been observed in safety injection lines (IN 97-19 and 84-18), charging pump casing cladding (INs 80-38 and 94-63), and instrument nozzles in safety injection tanks (IN 91-05).	
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.*	No
Same as effect of Crevice and Pitting Corrosion of Item D1.2.1 bowl/casing for HPSI and LPSI pumps.	*Same as effect of Crevice and Pitting Corrosion of Item D1.2.1 bowl/casing for HPSI and LPSI pumps.*	Yes, Element 4 should be further evaluated
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.8 Bolting for flange connections in Items D1.1.1 thru D1.1.7.	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.8 Bolting for flange connections in Items D1.1.1 thru D1.1.7.*	No
Components have been designed for fatigue for a 40 y design life according to the requirements of ANSI B31.1.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, check Code limits for allowable cycles (less than 7000 cycles) of thermal stress range.	Yes TLAA
Inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, testing category B-P for pressure retaining Class 1 components; Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; and Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling system; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 pumps and valves, additional staff guidelines of NRC Generic Letter (GL) 89-04 regarding the scope of inservice testing (IST) and information in NRC IN 88-70 regarding scope and testing of safety-related check	The program relies on preventive measures to mitigate crevice or pitting corrosion and a combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of corrosion. However, inadvertent introduction of contaminants into the coolant system can occur, e.g., contaminants in the boric acid introduced through the free surface of spent fuel pool (Information Notice (IN) 84-10), or from water from the sump. The aging management program must therefore rely upon inservice inspections in accordance with ASME Section XI to detect possible degradation. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors	Yes, Element 4 should be further evaluated

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(SEE CHANTICLEER #11)

CHEMISTRY CONTROL PROGRAM

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
(continued from previous page) valves, and in GL 96-05 regarding safety-related motor-operated valves. IST is performed in accordance with ASME Subsection IWV (Operation and Maintenance Code Appendix I and Subsection ISTC), to ensure that the changes in design-basis performance of safety-related valves resulting from degradation can be identified and managed. Water chemistry program for ~~minimizing impurities by monitoring~~ and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry.	*(continued from previous page)* the effects of corrosion by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 1 components according to Table IWB 2500-1 category B-P; pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H; and Class 3 components in support of emergency core cooling, according to Table IWD 2500-1 category D-B. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 pumps and valves and additional guidelines of NRC GLs 89-04 and 96-05, IST is performed in accordance with ASME Subsection IWV (OM Code Appendix I and Subsection ISTC). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWB-3100 and acceptance standards of IWB-3400 and IWB-3522 for Class 1 components, IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components, IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Corrosion has been observed in guide rings of relief valves (IN 98-23) and charging pump casing (IN 94-63).	

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.4.1	Valves (Check, Control, Hand, Motor Operated, and Relief Valves)	Body and Bonnet	SS, CS with SS cladding	25-340°C, chemically treated borated water	Crack Initiation and Growth	SCC	~~ASME Section XI, 1989 Edition.~~ Regulatory Guide ~~1.44.~~ 1.43 EPRI TR-105714 Plant Technical Specifications. *Operating Experience* NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19.

V ENGINEERED SAFETY FEATURES
D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, examination categories B-M-1 and B-M-2 for Class 1 valves; Table IWC 2500-1, examination category C-G for pressure retaining welds in Class 2 valves. Water chemistry program for minimizing impurities by monitoring and maintaining water chemistry conditions based on guidelines of EPRI TR-105714 for primary water chemistry.	~~(1) Scope of Program: The program includes~~ preventive measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Selection of material in compliance with the requirements of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens, sulfates, and oxygen in the primary water to less than 0.05, 0.05, and 0.005 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. ~~However, inadvertent introduction of contaminants into the coolant system can occur (e.g., contaminants in the boric acid, or introduced through the free surface of spent fuel pool) (NRC Information Notice (IN) 84-18), or from water from the sump. The AMP must therefore rely upon ISI in accordance with ASME Section XI to detect possible degradation.~~ ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on intended function of the valves by detection and sizing of cracks by ISI. Inspection requirements of Table IWB 2500-1 for Class 1 valves, examination category B-M-1 specify for all welds NPS 4 or larger, volumetric examination extending 1/2 in. on either side of the weld and through wall thickness, and for welds less than NPS 4, surface examination of OD surface extending 1/2 in. on either side of the weld. Category B-M-2 specifies visual VT-3 examination of internal surfaces of the valve. Table IWC 2500-1 for Class 2 valves, category C-G specifies for all valves in each piping run examined under category C-F, surface examination of either the inside or outside surface of all welds extending 1/2 in. on either side of the weld. In a group of multiple valves of similar design, size, function, and service in a system, examination of only one valve is required. ***(4) Detection of Aging Effects:*** Degradation of valves due to SCC can not occur without crack initiation and growth; ISI schedule assures detection of cracks or degradation of valve performance before the loss of intended function of the valves. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWB-2400 or IWC-2400 should provide timely detection of cracks. All welds are inspected each inspection period from at least one valve in each group with similar design and performing similar functions in the system. Visual examination is required only when the valve is disassembled for maintenance, repair, or volumetric examination, but at least once during the period. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWB-3400 and IWB-3518 for volumetric and surface examination of welds or IWB-3519 for visual examination of valve internal surfaces and IWC-3400 and IWC-3515 for surface examination of welds in Class 2 valves. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative***	No

CHEMISTRY CONTROL PROGRAM VD1-1

(SEE CHAPTER XI #11)

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.4.1, D1.4.2	Valves (Check, Control, Hand, Motor Operated, and Relief Valves)	Body and Bonnet (External Surfaces), Bolting	Body and Bonnet: CS; Nuts: CS, Bolts/Studs: Alloy Steel	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications)
D1.5.1 thru D1.5.4	Heat Exchangers (Reactor Coolant Pump Seal, HPSI Pump Seal, LPSI Pump Seal, RHR or SDC)	Bonnet/Cover, Tubing, Shell, Case/Cover	Bonnet/ Cover & Tubing: SS, Shell: CS, Case/Cover: Cast iron	Chemically treated borated water; and treated component cooling water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ ASME OM S/G, Pt 2. NRC GL 89-13. EPRI TR-~~105714.~~ Plant Technical Specifications. 107396

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels and control of primary water chemistry, significant potential of SCC exists from inadvertent introduction of contaminants into the primary coolant system (IN 84–18). SCC has been observed in safety injection lines (IN 97-19 and 84-18), charging pump casing cladding (INs 80-38 and 94-63), and instrument nozzles in safety injection tanks (IN 91-05).	
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.*	No
[redacted] radiation monitors in component cooling system; inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB 2500-1, testing category B-P for pressure retaining Class 1 components, Table IWC 2500-1, [redacted] retaining Class 2 components; performance testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the heat exchanger serviced by the closed-cycle cooling water system is performing its function [redacted] and water chemistry control program based on EPRI TR-105714 primary water and plant technical specifications for cooling water.	***Scope of Program:*** The program includes monitoring and control of water chemistry and cooling water chemistry to minimize exposure to aggressive environments, and performance testing in accordance with ASME OM Standards and Guides, Part 2 provides assurance that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably. ***(2) Preventive Actions:*** Use of appropriate materials, lining or coating to protect the underlying metal surfaces, and control of primary water chemistry and cooling water chemistry to minimize exposure to aggressive environment. The parameters monitored include halogens, sulfates, oxygen, and pH in the primary water, and in addition to these, dissolved copper and iron, suspended solids, and gamma activity, in the component cooling water. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. The parameters monitored are directly related to corrosion, e.g., dissolved iron and copper, and by detection of leakage by radiation monitors, in the component cooling system. Also, inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 1 components extending to and including the second closed valve at the boundary extremity, according to Table IWB 2500-1 category B-P, and pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H. Performance testing is conducted in accordance with ASME OM S/G, Part 2. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance. Monitoring of radiation and suspended	No

CHEMISTRY CONTROL PROGRAM VD1-1

(SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.5.3 thru D1.5.5	Heat Exchangers (RCP Seal, HPSI Pump Seal, LPSI Pump Seal, RHR or SDC)	Shell, Case/Cover, (External Surfaces); Bolting	Shell: CS; Case/Cover: Cast iron; Nuts: CS, Bolts/Studs: Alloy Steel	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications.
D1.6.1 thru D1.6.3	Heat Exchanger (RWT Heating)	Bonnet and Cover, Tubing, Shell	Bonnet/ Cover & Tubing: SS, Shell: CS	Chemically treated borated water; and untreated cooling water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ ASME OM S/G, Pt 2. NRC GL 89-13. EPRI TR-105714. Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) solids would detect the existence of corrosion; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify the heat transfer capabilities are trended. Also, based on the recommendations of NRC GL 89-13 or its equivalent, if adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to include inspection and maintenance program for closed-cycle cooling water system to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety related systems serviced by closed-cycle cooling water. ***(6) Acceptance Criteria:*** Heat exchanger performance test results are evaluated in accordance with the guidelines of ASME OM S/G Part 2. Maximum levels for various impurities in secondary side water and cooling water are specified. Results of Section XI leakage tests are evaluated in accordance with IWB-3100 and acceptance standards of IWB-3400 and IWB-3522 for Class 1 components, and IWC-3100 and acceptance standards of IWC-3400 and IWB- 3516 for Class 2 components. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken in accordance with OM S/G Part 2. Root cause evaluation and appropriate corrective action when acceptable limits are exceeded or leakage is detected. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Operating plant experience with this AMP indicate timely detection of corrosion in the ECCS heat exchangers.	
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.*	No
Inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, examination category D-B for systems in support of emergency core cooling; performance testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably; and water chemistry control program based on EPRI TR-105714 for primary water and plant technical specifications for cooling water	***(1) Scope of Program:*** The program includes monitoring and control of water chemistry and cooling water chemistry to minimize exposure to aggressive environments, and inservice inspection and performance testing provides assurance that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably. ***(2) Preventive Actions:*** Use of appropriate materials, lining or coating to protect the underlying metal surfaces, and control of primary water chemistry based on EPRI guidelines of TR-105714 and cooling water chemistry based on the plant technical specifications to minimize exposure to aggressive environment. The parameters monitored include halogens, sulfates, oxygen, and pH in the	No

SEE CHAPTER II

CHEMISTRY CONTROL PROGRAM VD1-1

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.6.3, D1.6.4	Heat Exchanger (RWT Heating)	Shell (External Surface), Bolting	Shell: CS, Nuts: CS, Bolts/Studs: Alloy Steel	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications.
D1.7.1	Safety Injection Tank (Accumulators)	Shell (External Surface)	CS with SS cladding	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications.

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	primary water, and in addition to these, dissolved co[illegible] and iron, and suspended solids in the component cooling water. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. Inspection requirements of ASME Section XI, Table IWB-2500-1, examination category D-B specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic test of all pressure retaining Class 3 components in support of emergency core cooling. Performance testing is conducted in accordance with ASME OM S/G, Part 2. ***(4) Detection of*** [illegible] would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify the heat transfer capabilities are trended. Also, based on the recommendations of NRC GL 89-13 or its equivalent, if adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to include inspection and maintenance program for closed-cycle cooling water system to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety-related systems serviced by closed-cycle cooling water. ***(6) Acceptance Criteria:*** Heat exchanger performance test results are evaluated in accordance with the guidelines of ASME OM S/G Part 2. Maximum levels for various impurities in secondary side water and cooling water are specified. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken in accordance with OM S/G Part 2. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be [illegible] ***Experience:*** The AMP has been effective in managing the effects of corrosion in RWT heat exchanger.	
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.*	No
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.*	No

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.7.1 thru D1.7.3	Safety Injection Tank (Accumulators)	Shell, Manway, Penetrations/ Nozzles	Shell: CS with SS cladding, Other: SS	Chemically treated borated water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ Plant Technical Specifications.

ENGINEERED SAFETY FEATURES
D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components, and water chemistry control program based on plant technical specifications.	~~(1) Scope of Program: The program relies on preventive~~ measures to mitigate crevice or pitting corrosion and inservice inspection (ISI) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** The system is filled with borated water with controlled water chemistry. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by detection of coolant leakage by ISI. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 2 components required to operate or support the safety function up to the first normally closed valve, according to Table IWC 2500-1 category C-H. ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at mechanical joints because they present a crevice geometry at the sealing surfaces that may allow buildup of impurities due to stagnant conditions.	~~Yes, Element 4 should be further evaluated~~ NO VD-1-1

CHEMISTRY CONTROL PROGRAM VD 1-1 (SEE CHAPTER #11)

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.7.3	Safety Injection Tank (Accumulators)	Penetrations/ Nozzles	CS with SS cladding	Chemically treated borated water	Crack Initiation and Growth	SCC	~~ASME Section XI, 1989 Edition~~ Regulatory Guide ~~1.44~~ 1.43 Plant Technical Specifications. *Operating Experience* NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN ~~94-63~~. NRC IN 97-19.

1.43

V ENGINEERED SAFETY FEATURES
D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components, and water chemistry control program based on plant technical specifications.	[redacted] measures to mitigate stress corrosion cracking (SCC) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of the RWT. ***(2) Preventive Actions:*** Selection of material in compliance with the requirements of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on intended function of the RWT by detection of leakage. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 2 components required to operate or support the safety function, according to Table IWC 2500-1 category C-H. ***(4) Detection of Aging Effects:*** Degradation of the component due to SCC can not occur without leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on [redacted] margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** SCC has been observed in safety injection lines (IN 97-19 & 84-18), charging pump casing cladding (INs 80-38 and 94-63), and [redacted]	Yes, Element 4 should be further evaluated

CHEMISTRY CONTROL PROGRAM

V D1-1 (SEE CHAPTER #11)

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR THE CHEM. CONTROL PROGRAM.

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.8.1 thru D1.8.3	Refueling Water Tank (RWT)	Shell, Manhole, Penetrations/ Nozzles	SS	Chemically treated borated water	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition.
D1.8.3	Refueling Water Tank (RWT)	Penetrations/ Nozzles	SS	Chemically treated borated water	Crack Initiation and Growth	SCC	~~ASME Section XI, 1989 Edition.~~ Regulatory Guide ~~1.44.~~ 1.43 NRC IN 80-38. NRC IN 84-18. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19.

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB-2500-1, test and examination category D-B for systems in support of emergency core cooling, and water chemistry control program based on plant technical specifications.	~~(1) Scope of Program: The program relies on preventive~~ measures to mitigate crevice or pitting corrosion and inservice inspection (ISI) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Control of water chemistry based on plant technical specifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by detection of coolant leakage by ISI. Inspection requirements of ASME Section XI, Table IWB-2500-1, category D-B specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 3 components in support of emergency core cooling. ~~(4) Detection of Aging Effects: Degradation of~~ component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000 for Class 3 components. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at crevices that may allow buildup of impurities due to stagnant conditions.	~~Yes, Element 4 should be further evaluated~~ NO
~~Guidelines of Regulatory Guide (RG) ... to avoid sensitization of stainless steels, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWB-2500-1, test and examination ... D-B for ... in support of emergency core cooling, and water chemistry control program based on plant technical specifications.~~	***(1) Scope of Program:*** The program includes preventive measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of the RWT. ***(2) Preventive Actions:*** Selection of material in compliance with the requirements of Regulatory Guide (RG) ... prevents or mitigates SCC. Control of water chemistry is based on plant technical specifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of SCC on intended function of the RWT by	~~Yes, Element 4 should be further evaluated~~ NO

SEE CHAPTER VII

CHEMISTRY CONTROL PROGRAM VD1-1

SEE CHAPTER VII BASIS FOR THE CHEM. CONTROL PROGRAM.

CHEMISTRY CONTROL PROGRAM VD1-1

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.8.4	Refueling Water Tank (RWT)	Bolting	Nuts: CS. Bolts/Studs: Alloy Steel	Air, leaking chemically treated borated water	Loss of Material	Corrosion/ Boric Acid Wastage of External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) detection of leakage. Inspection requirements of ASME Section XI, Table IWD 2500-1, category D-B specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 3 components in support of emergency core cooling. ***(4) Detection of Aging Effects:*** Degradation of the component due to SCC can not occur without leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI should provide for timely detection of leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000 for Class 3 components. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Although the primary pressure boundary piping of PWRs have generally not been found to be affected by SCC because of low dissolved oxygen levels and control of primary water chemistry, significant potential of SCC exists from inadvertent introduction of contaminants into the primary coolant system (IN 84-18). SCC has been observed in safety injection lines (IN 97-19 and 94-18), charging pump casing cladding (INs 80-30 and 94-63), internal bolting in swing check valves (IN 89-02), and instrument nozzles in safety injection tanks (IN 91-08).	
Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.	*Same as effect of Corrosion/Boric Acid Wastage of Item D1.1.7 Bolting for flange connections in Items D1.1.1 thru D1.1.5.*	No

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.8.5	Refueling Water Tank (RWT)	Perimeter Seal	Cold plastic coal tar pitch flashing or other organic sealants	Outside atmosphere	Loss of elasticity (drying out)	Weathering	Plant Technical Specifications

V ENGINEERED SAFETY FEATURES

D1. EMERGENCY CORE COOLING SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management program will be evaluated.	Yes no AMP

D2 Emergency Core Cooling System (BWR)

D2.1 Piping & Fittings

- D2.1.1 High Pressure Coolant Injection (HPCI)
- D2.1.2 Reactor Core Isolation Cooling (RCIC)
- D2.1.3 High-Pressure Core Spray (HPCS)
- D2.1.4 Low-Pressure Core Spray (LPCS)
- D2.1.5 Low Pressure Coolant Injection (LPCI) or Residual Heat Removal (RHR)
- D2.1.6 Lines to Spent Fuel Pool (SFP) and Suppression Chamber (SC)
- D2.1.7 Lines to Containment Spray System (CSS)
- D2.1.8 Automatic Depressurization System (ADS)
- D2.1.9 Lines to HPCI and RCIC Pump Turbine
- D2.1.10 Lines from HPCI and RCIC Pump Turbines to Condenser

D2.2 Pumps (HPCS or HPCI Main & Booster, LPCS, LPCI or RHR, & RCIC)

- D2.2.1 Bowl/Casing
- D2.2.2 Suction Head
- D2.2.3 Discharge Head

D2.3 Valves (Check, Control, Hand, Motor Operated, & Relief Valves)

- D2.3.1 Body and Bonnet

D2.4 Heat Exchangers (RHR & LPCI)

- D2.4.1 Tubes
- D2.4.2 Tubesheet
- D2.4.3 Channel Head
- D2.4.4 Shell

D2.5 Header and Spray Nozzles System

D2.5.1 Piping and Fittings

D2.5.2 Flow Orifice

D2.5.3 Headers

D2.5.4 Spray Nozzles

D2.6 Isolation Condenser

D2.6.1 Tubing

D2.6.2 Tubesheet

D2.6.3 Channel Head

D2.6.4 Shell

D2. Emergency Core Cooling System (Boiling Water Reactors)

System, Structures, and Components

The system, structures, and components included in this table comprise 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, and consist of the high-pressure coolant injection (HPCI), reactor core isolation cooling (RCIC), high-pressure core spray (HPCS), automatic depressurization system (ADS), low-pressure core spray (LPCS), low-pressure coolant injection (LPCI) or residual heat removal (RHR), including various pumps and valves, RHR heat exchangers, isolation condenser, and containment spray system (CSS). Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the emergency core cooling system outside the containment are classified as Group B Quality Standards and portion of the CSS inside the containment up to the isolation valve is classified Group A Quality Standard. Portion of the HPCI, RCIC, HPCS, LPCS, and LPCI (or RHR) systems extending from the reactor vessel up to the second isolation valve outside the containment are classified as Group A and are covered in Table IV C1. The aging management program for the variety of lines that penetrate the containment and associated isolation valves is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the steam turbine system include the reactor coolant pressure boundary (Table IV C1), feedwater system (Table VIII D2), condensate system (Table VIII E), nitrogen system (Table VIII H), spent fuel pool cooling and cleanup (Table VII A4), suppression pool cleanup system (Table VII A5), and closed cycle cooling water (Table VII C2).

SEE VD2-T NEED TO DEFINE

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.1.1 thru D2.1.7	Piping & Fittings	High Pressure Coolant Injection (HPCI), Reactor Core Isolation Cooling (RCIC), High-Pressure Core Spray (HPCS), Low-Pressure Core Spray (LPCS), Low Pressure Coolant Injection (LPCI) or Residual Heat Removal (RHR), Lines to Spent Fuel Pool (SFP) & Suppression Chamber (SC), Lines to Containment Spray System (CSS)	Carbon Steel (CS)	25-288°C, Oxygenated Water	Loss of Material	General, Crevice, and Pitting Corrosion	ASME Section XI, 1989 Edition, EPRI TR-103515, Plant Technical Specifications

AND

SEE VD-2-1

V ENGINEERED SAFETY FEATURES
D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Water chemistry program based on EPRI guidelines of TR-103515 and implemented through the plant technical specifications for minimizing impurities by monitoring and maintaining water chemistry conditions, and inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components.	***(1) Scope of Program:*** The program relies on preventive measures to mitigate general, crevice, and pitting corrosion and inservice inspection (ISI) to monitor the effects of corrosion on emergency core cooling system components. ***(2) Preventive Actions:*** Mitigation is by monitoring and control of water chemistry to minimize concentration of corrosive impurities in accordance with the EPRI guidelines of TR-103515. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by detection of coolant leakage by inservice inspection (ISI). Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests of all pressure retaining Class 2 components according to Table IWC 2500-1 category C-H. ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. ***(5) Monitoring and Trending:*** System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair are in conformance with IWA-4000 and IWB-4000 and replacement according to IWA-7000 and IWB-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at mechanical joints, because of crevice geometry at the sealing surfaces that may allow buildup of impurities due to stagnant conditions. No significant corrosion related problem has been reported for piping and fittings in BWR emergency core cooling system.	Yes, Element 4 should be further evaluated

SEE GENERAL COMMENTS 1 & 2

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.1.1	Piping & Fittings	HPCI	Carbon Steel (CS), Stainless Steel (SS)	25-288°C, Oxygenated Water	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
D2.1.1 thru D2.1.7	Piping & Fittings	HPCI, RCIC, HPCS, LPCS, LPCI or RHR, Lines to SFP and SC, Lines to CSS	Stainless Steel (SS)	25-288°C, Oxygenated Water	Crack Initiation and Growth	Stress Corrosion Cracking (SCC), Inter-granular Stress Corrosion Cracking (IGSCC)	NUREG-0313, Rev. 2. NRC GL 88-01. ~~ASME Section XI, 1989 Edition.~~ BWRVIP-29. EPRI TR-103515. Regulatory Guide 1.45.

SEE V02-4

SEE V02-3

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Components have been designed for fatigue for a 40 y design life according to the requirements of ANSI B31.1.~~	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, check Code limits for allowable cycles (less than 7000 cycles) of thermal stress range.	Yes TLAA
~~Program delineated in NUREG-0313~~ Rev. 2 and implemented through NRC Generic letter (GL) 88-01, and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-F-1 for pressure retaining welds in Class 2 stainless steel piping, and testing category C-H for system leakage. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in TR-103515 and BWRVIP-29 to minimize the potential of crack initiation and growth.	***(1) Scope of Program:*** The program is focused on managing and implementing the counter measures to mitigate IGSCC and inservice inspection (ISI) to monitor IGSCC and its effects on the intended function of austenitic stainless steel (SS) piping 4 in. or larger in diameter and contains water at a temperature above 93°C (above 200°F) during power operation regardless of Code classification. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding mitigating IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of austenitic SSs and weld metal, with a maximum carbon of 0.035% and minimum 7.5% ferrite in weld metal, and by special processing such as solution heat treatment, heat sink welding, and induction heating or mechanical stress improvement. ***(3) Parameters Monitored/Inspected:*** The AMP monitors IGSCC of austenitic SS piping by detection and sizing of cracks by implementing the inspection requirements delineated in GL 88-01 including guidelines for inspection schedule, methods, personnel, sample expansion, and leak detection requirements. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, or any other formal program approved by the NRC. Inspection requirements of testing category C-H specify visual VT-2 (IWA-5240) examination of all pressure retaining Class 2 components during system leakage test (IWB-5221) and system hydrostatic test (IWB-5222). Leakage detection is in conformance with Position C of Regulatory Guide 1.45 and the guidelines in GL 88-01. Coolant water chemistry is monitored and maintained in accordance with the EPRI guidelines in BWRVIP-29 to minimize the potential of crack initiation and growth. ***(4) Detection of Aging Effects:*** Aging degradation of the piping can not occur without crack initiation and growth; extent and schedule of inspection as delineated in GL 88-01 is adequate and assures timely detection of cracks before the loss of intended function of austenitic SS piping and fittings. ***(5) Monitoring and Trending:*** Inspection schedule and sample size specified in Table 1 of GL 88-01 are based on the IGSCC susceptibility of each weld and are adequate for timely detection of cracks. Welds of resistant material are as a minimum examined according to an extent and frequency comparable to those of ASME Section XI, e.g., 25% are examined every 10 y, at least 12% in 6 y. Inspection extent and schedule are enhanced for welds of non-resistant materials, or such welds that have been treated by SI or reinforced by weld overlay. ***(6) Acceptance***	No

GENERAL COMMENT #1

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.1.8	Piping & Fittings	Automatic Depressurization System (ADS)	CS, SS	Moist Containment Atmosphere (Air/Nitrogen), Steam, or Oxygenated Water	Loss of Material	General, Crevice, and Pitting Corrosion	Plant Technical Specifications.
D2.1.9, D2.1.10	Piping & Fittings	Lines to HPCI & RCIC Pump Turbine, Lines from HPCI & RCIC Pump Turbine to Condenser	CS	Air and Steam up to 320°C	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. EPRI NSAC-202L-R2. NRC GL 89-08 NRC IN 93-21. EPRI TR-103515. BWRVIP-29. *Operating Experience* NRC IN 89-53 NRC IN 91-18 NRC IN 91-18 S1 NRC IN 97-84

SEE VD2-6

SEE VD2-6

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***Criteria:*** Any IGSCC degradation is evaluated in accordance with IWB-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3514. Planar and liner flaws are evaluated according to IWA-3300 and IWA-3400. ***(7) Corrective Actions:*** Repair is in conformance with IWA-4000 and IWB-4000 or GL 88-01. Continued operation without repair requires that crack growth calculation be performed according to the guidance of GL 88-01 or other approved procedures. Repair methods include weld overlay reinforcement or partial replacement. Approved clamping devices may be used for temporary reinforcement of cracked weldments. SI is considered effective mitigation for short and shallow cracks, e.g., not longer than 10% of circumference and not deeper than 30% of wall thickness. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** IGSCC has occurred in small- and large-diameter BWR piping made of austenitic SSs. Significant cracking has occurred in RHR system and reactor water cleanup system piping welds. The AMP delineated in GL 88-01 has been effective in managing the effects of IGSCC in SS piping.	
Plant specific aging management program.	Plant specific aging management program is to be evaluated.	Yes, no AMP
Program delineated in NUREG-1344 for single phase lines and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines in TR-103515 and BWRVIP-29 for water chemistry in BWRs.	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. Although technical aspects of the CHECWORKS Code, including the parameters and inputs, are acceptable, the EPRI guidance document NSAC-202L-R2 (April 1999) is too general to ensure applicant's flow-accelerated corrosion program will be effective in managing aging in safety-related systems. However, E/C is not considered to	Yes, Element 1 should be further evaluated

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) be an issue for the steam lines to pump turbines. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. However, NRC staff has identified the problems in implementing E/C program that pertain to weakness or errors in (a) using predictive models, (b) calculating minimum wall thickness acceptance criteria, (c) analyzing the results of UT examinations, and (d) assessment of E/C program activities (NRC Information Notice IN 93-21). ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjustment of chemistry and operating parameters, or selection of materials resistant to E/C. However, NRC staff has identified weakness or errors in (a) dispositioning components after reviewing the results of the inspection analysis, and (b) repairing or replacing components that failed to meet the acceptance criteria (IN 93-21). ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are	

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.2.1 thru D2.2.3	Pumps HPCS or HPCI Main & Booster, LPCS, LPCI or RHR, & RCIC	Bowl/Casing, Suction Head, Discharge Head	CS Casting, CS	25-288°C, Oxygenated Water	Loss of Material	General, Crevice, and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Subsection ISTB. NRC GL 89-04. EPRI TR-103515. Plant Technical Specifications.

SEE GENERAL COMMENTS 1 & 2

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in two-phase piping have occurred in extraction steam lines (INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (INs 89-53, 91-18, 93-21, 97-84).	
Water chemistry program based on EPRI guidelines of TR-103515 and implemented through the plant technical specifications for minimizing impurities by monitoring and maintaining water chemistry conditions; inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 pumps, and additional NRC staff guidelines of NRC Generic Letter 89-04, inservice testing performed in accordance with ASME Subsection IWP (or Operation and Maintenance Code Subsection ISTB) for pumps, or other approved program in the plant specifications.	***(1) Scope of Program:*** The program relies on preventive measures to mitigate general, crevice, and pitting corrosion and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Mitigation is by monitoring and control of water chemistry to minimize concentration of corrosive impurities in accordance with EPRI guidelines of TR-103515 and implemented through the plant technical specifications. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of corrosion by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 components according to Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 2 pumps and additional guidelines of NRC Generic Letter (GL) 89-04, IST is performed in accordance with ASME Subsection IWP (or OM Code Subsection ISTB). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant or degradation of component performance. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. ***(5) Monitoring and Trending:*** ISI/IST schedule of ASME Section XI should provide for timely detection of corrosion. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Prior to service.	Yes, Element 4 should be further evaluated

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.3.1	Valves (Check, Control, Hand, Motor Operated, & Relief Valves)	Body and Bonnet	CS forging, CS casting	25-288°C, Oxygenated Water	Wall Thinning	Erosion/ Corrosion	NUREG-1344. EPRI NSAC-202L-R2. NRC GL 89-08 NRC IN 93-21. EPRI TR-103515. BWRVIP-29.
D2.3.1	Valves (Check, Control, Hand, Motor Operated, & Relief Valves)	Body and Bonnet	CS forging, CS casting	25-288°C, Oxygenated Water	Loss of Material	General, Crevice, and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Appendix I and Subsection ISTC. EPRI TR-103515. NRC GL 89-04. NRC GL 90-06. NRC GL 96-05. NRC IN 88-70. NRC IN 98-24, Plant Technical Specifications.

SEE GENERAL COMMENTS 1 & 2

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at flange connections and other crevices where buildup of impurities can occur. No significant corrosion related problem has been reported for pumps in BWR emergency core cooling system.	
Same as for Erosion/Corrosion of Item D2.1.9 lines to HPCI & RCIC pump turbine and D2.1.10 lines from HPCI & RCIC pump turbine to condenser.	*Same as for Erosion/Corrosion of Item D2.1.9 lines to HPCI & RCIC pump turbine and D2.1.10 lines from HPCI & RCIC pump turbine to condenser.*	Yes, Element 1 should be further evaluated
Water chemistry program based on EPRI guidelines of TR-103515 and implemented through the plant technical specifications for minimizing impurities by monitoring and maintaining water chemistry conditions; inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 valves, staff guidelines of NRC Generic Letter (GL) 89-04 regarding the scope of inservice testing (IST), and information in NRC IN 88-70 regarding scope and testing of safety-related check valves, and in GL 96-05 regarding safety-related motor-operated valves, IST is performed in accordance with ASME Subsection IWV (Operation and Maintenance Code Appendix I and Subsection ISTC), to ensure that the changes in design-basis performance of safety-related valves resulting from degradation can be identified and managed.	***(1) Scope of Program:*** The program relies on preventive measures to mitigate crevice or pitting corrosion and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of emergency core cooling system components. ***(2) Preventive Actions:*** Mitigation is by monitoring and control of water chemistry to minimize concentration of corrosive impurities by following EPRI guidelines of TR-103515 and implemented through the plant technical specifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 components, according to Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 2 valves and additional guidelines of NRC GLs 89-04 and 96-05, IST is performed in accordance with ASME Subsection IWV (OM Code Appendix I and Subsection ISTC). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant or degradation of component performance. However, a one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. ***(5) Monitoring and Trending:*** ISI/IST	Yes, Element 4 should be further evaluated

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.3.1	Valves (Check, Control, Hand, Motor Operated, & Relief Valves)	Body and Bonnet	SS forging, SS casting	25-288°C, Oxygenated Water	Crack Initiation and Growth	SCC	NUREG-0313, Rev. 2. NRC GL 88-01. ASME Section XI, 1989 Edition. BWRVIP-29. EPRI TR-103515.

SEE GENERIC COMMENTS 1 & 2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) schedule of ASME Section XI should provide for timely detection of corrosion. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. The results of one-time inspection should be used to dictate the frequency of future inspections. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWC-3516 for Class 2 components. Any evidence of aging effects or unacceptable results are evaluated. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair is in conformance with IWA-4000 and replacement according to IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at crevice geometry where buildup of impurities can occur. Failure of steam turbine governor valves due to corrosion scale buildup has occurred in RCIC and AFW systems (NRC IN 98-24).	
Program delineated in NUREG-0313, Rev. 2 and implemented through NRC Generic letter (GL) 88-01, and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-G for pressure retaining welds in Class 2 valves, and category C-H for system leakage. Coolant water chemistry is monitored and maintained in accordance with EPRI guidelines in TR-103515 and BWRVIP-29 to minimize the potential of crack initiation and growth.	***(1) Scope of Program:*** The program includes implementing counter measures to mitigate stress corrosion cracking (SCC) of stainless steel (SS) and combination of inservice inspection (ISI) to monitor SCC and its effects on the intended function of valves. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding mitigating IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of cast SSs and weld metal, with a maximum carbon of 0.035% and minimum 7.5% ferrite. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors SCC of valves by detection and sizing of cracks by implementing the inspection schedule, methods, personnel, sample expansion, and leak detection requirements of GL 88-01. In a group of multiple valves of similar design, size, function, and service in a system, examination of only one valve is required. Coolant water chemistry is monitored and maintained in accordance with the EPRI guidelines in BWRVIP-29 to minimize the potential of crack initiation and growth. ***(4) Detection of Aging Effects:*** Degradation of valves due to SCC can not occur without crack initiation and growth; ISI schedule delineated in the AMP is adequate and will assure detection of cracks or degradation of valve performance before the loss of intended function of valves. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with GL 88-01 should provide timely detection of cracks. All welds are inspected each inspection period from at least one valve in each group with similar design	No

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.4.1 thru D2.4.4	Heat Exchangers (RHR & LPCI) (Serviced by Closed Cycle Cooling Water)	Tubes, Tubesheet, Channel & Head, Shell	Carbon Steel (CS)	Oxygenated Water on one side; Closed Cycle Cooling Water (Treated Water) on the other side	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM-S/G, Pt 2. NRC GL 89-13. Plant Technical Specifications.

SEE VD2-9

SEE VD2-10

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) and performing similar functions in the system. Visual examination is performed only when the valve is disassembled for maintenance, repair, or volumetric examination, but at least once during the period. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3515. ***(7) Corrective Actions:*** Repair is in conformance with IWA-4000 and replacement is in accordance with IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** The comprehensive AMP outlined in GL 88-01 addresses improvements in all three elements that cause SCC, e.g., a susceptible material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring structural integrity of BWR components.	
Detection of reactor coolant leakage by radiation and temperature monitors in component cooling system; inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components; performance testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably; and control of system water chemistries in suppression pool and component cooling water based on the plant technical specifications to minimize exposure to aggressive environments.	***(1) Scope of Program:*** The program includes monitoring and control of ECCS water chemistry to minimize exposure to aggressive environments, and performance testing in accordance with ASME OM-Standards and Guides, Part 2 provides assurance that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably. ***(2) Preventive Actions:*** Monitor and control of suppression pool and component cooling system water chemistries based on the plant technical specifications to minimize impurities, and timely corrective action prevent or mitigate corrosion. The parameters monitored include halogens, sulfates, oxygen, and pH in the suppression pool water, and in addition to these, dissolved copper and iron, suspended solids, and gamma activity in the component cooling water. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. The parameters monitored are directly related to corrosion, e.g., dissolved iron and copper, and by detection of leakage by radiation and temperature monitors, in the component cooling system. Also, inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 components according to Table IWC 2500-1 category C-H. Performance testing is conducted in accordance with ASME OM S/G, Part 2. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance. Monitoring of radiation and suspended solids would detect leakage; extent and schedule of	No

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.4.1 thru D2.4.4	Heat Exchangers (RHR & LPCI) (Serviced by Open Cycle Cooling Water)	Tubes, Tubesheet, Channel & Head, Shell	Carbon Steel (CS), Stainless Steel (SS)	Oxygenated Water on one side; Open Cycle Cooling Water (Raw Water) on the other side	Loss of Material	General Corrosion and Microbiologically Influenced Corrosion (MIC)	NRC GL 89-13. NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96. NRC IN 94-03. Plant Technical Specification.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify the heat transfer capabilities are trended. Also, based on the recommendations of NRC GL 89-13 or its equivalent, if adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to include inspection and maintenance program for closed-cycle cooling water system to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety-related systems serviced by closed-cycle cooling water. ***(6) Acceptance Criteria:*** Heat exchanger performance test results are evaluated in accordance with the guidelines of ASME OM S/G Part 2. Any relevant conditions related to corrosion causing leakage of ECCS water are compared with established acceptable limits. Results of Section XI leakage tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516. ***(7) Corrective Actions:*** Root cause evaluation and appropriate corrective action taken when acceptable limits are exceeded or leakage is detected. Repair is in conformance with IWA-4000 and replacement is in accordance with IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Operating plant experience with this AMP indicate timely detection of corrosion in ECCS heat exchangers.	
Implementation of the recommendations of Generic Letter 89-13 or an equally effective program to ensure that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Mitigation is by control of ECCS water chemistry and the use of appropriate materials and lining/coating to protect the underlying metal surfaces from being exposed to environments causing MIC and biofouling.	***(1) Scope of Program:*** The program includes monitoring and control of water chemistry to minimize exposure to environments causing MIC and biofouling, and staff recommendations of Generic Letter (GL) 89-13 or an equivalent program provide assurance that the service cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Guidelines of GL 89-13 include (a) surveillance and control of biofouling, (b) test program to verify heat transfer capabilities, (c) routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling, can not degrade the performance of safety-related systems serviced by the service water, (d) system walkdown inspection to ensure compliance with licensing basis, and (e) review of maintenance, operating, and training practices and procedures. ***(2) Preventive Actions:*** The component is constructed of appropriate materials, control of water chemistry is based on EPRI guidelines of TR-103515, and lining or coating protect the underlying metal surfaces from being exposed to aggressive cooling water environment. Based on GL 89-13 cooling water	No

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.4.1 thru D2.4.4	Heat Exchangers (RHR & LPCI) (Serviced by Open Cycle Cooling Water)	Tubes, Tubesheet, Channel & Head, Shell	Carbon Steel (CS), Stainless Steel (SS)	Oxygenated Water on one side; Open Cycle Cooling Water (Raw Water) on the other side	Buildup of Deposit	Biofouling	*Same as for General Corrosion and MIC of Items D2.4.1 thru D2.4 RHR and LPCI heat exchanger components*
D2.5.1 thru D2.5.4	Containment Spray Header and Spray Nozzles System	Piping and Fittings, Flow Orifice, Headers, Spray Nozzles	CS, SS	Air	Loss of Material	General, Pitting, and Crevice Corrosion	Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) system is continuously chlorinated or treated with biocide whenever the potential for biological fouling species exists. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. Based on recommendations of GL 89-13 or its equivalent, cooling water system is inspected for biofouling organisms, sediment, protective coating failure, and corrosion; and cooling water flow and temperature are monitored for component performance evaluation to ensure that flow blockage or excessive fouling accumulation does not exist. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify heat transfer capabilities are trended. ***(6) Acceptance Criteria:*** Any relevant conditions related to corrosion or leakage are compared to established acceptable limits. Maximum levels for various impurities in secondary side water and cooling water are specified. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken. Root cause evaluation is performed when acceptable limits are exceeded or leakage is detected. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Significant microbiologically influenced corrosion [NRC Information Notice (IN) 85-30], failure of protective coatings (IN 85-24), and fouling (IN 81-21, 86-96) has been observed in a number of heat exchangers. Although the AMP provides an effective means to manage the effects of corrosion on the intended function of ECCS heat exchangers, results of service water system operational performance inspections (IN 94-03) indicate that deficiencies still exist in implementation of GL 89-13.	
Same as for General Corrosion and MIC of Items D2.4.1 thru D2.4 RHR and LPCI heat exchanger components	*Same as for General Corrosion and MIC of Items D2.4.1 thru D2.4 RHR and LPCI heat exchanger components*	No
Plant specific aging management program.	Plant specific aging management program is to be evaluated.	Yes, no AMP

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.6.1 thru D2.6.4	Isolation Condenser	Tubing, Tubesheet, Channel Head, Shell	Tubes: SS; Tubesheet: CS; Channel Head: CS; Shell: CS	Tube side: Steam at 288°C; Shell side: demineralized water at 288°C	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition.

V ENGINEERED SAFETY FEATURES

D2. EMERGENCY CORE COOLING SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as effect of Crevice and Pitting Corrosion of Items D2.4.1 thru D2.4.4 RHR and LPCI heat exchanger components	*Same as effect of Crevice and Pitting Corrosion of Items D2.4.1 thru D2.4.4 RHR and LPCI heat exchanger components*	No

E Fan Cooler System

E.1 Fan Coolers

E.1.1 Cooling Coils

E.1.2 Fan Housing

E.1.3 Blades

E.1.4 Fasteners

E.1.5 Piping

E.1.6 Fittings

E. Fan Cooler System

System, Structures, and Components

The system, structures, and components included in this table comprise the fan cooler system found in pressurized water reactors (PWR) and consist of cooling coils; fan housing, blades and fasteners; and piping and fittings. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the fan cooler system are classified as Group B Quality Standards.

System Interfaces

The systems that interface with the fan cooler system include the containment spray system (Table V A) and the containment isolation components (Table V C).

DELETE PER VE-2

SEE VE-1

V ENGINEERED SAFETY FEATURES
E. FAN COOLER SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E.1.1	Fan Coolers	Cooling coils	Cu-Ni alloy (typically 90% Cu-10% Ni)	Treated water from service water system	Loss of Material	General Corrosion	NRC IN 80-37
E.1.2 E.1.3 E.1.4	Fan Coolers	Fan housing, blades, and fasteners	Carbon Steel	Air, possible steam condensation	Cumulative fatigue damage	Fatigue	ASME Section III, 1969 Edition,
E.1.2 E.1.3 E.1.4	Fan Coolers	Fan housing, blades, and fasteners	Carbon Steel	Air, possible steam condensation	Loss of material	General Corrosion	
E.1.5 E.1.6	Fan Coolers	Piping and fittings	Carbon and Stainless Steel	Treated water from service water system	Loss of Material	General Corrosion	

SEE VE-4 FOR PIPING SPECIFICITY

SEE VE-5 FOR STAINLESS STEEL COMMENT

SEE VE-1

V ENGINEERED SAFETY FEATURES

E. FAN COOLER SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management program will be evaluated. One incident of containment cooler heat exchanger leakage caused by corrosion has been reported (NRC IN 80-37).	Yes. No generic AMP
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of the original licensing criteria or ASME Section III (edition specified in 10 CFR 50.55a).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal.	Yes. TLAA
Plant-specific aging management program, typically including periodic visual inspection	Plant-specific aging management program to be evaluated.	Yes. No generic AMP
Plant-specific aging management program.	Plant-specific aging management program will be evaluated.	Yes. No generic AMP

References

10 CFR 50, Appendix J, *Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors*, Office of the Federal Register, National Archives and Records Administration, January 1997.

ANSI B31.1, *USA Standard for Pressure Piping, Power Piping*, American National Standards Institute.

ASME OM Code, Appendix I, *Inservice Testing of Pressure Relief Devices in Light-Water Reactor Power Plants*, Code for Operation and Maintenance of Nuclear Power Plants, The American Society of Mechanical Engineers, New York, NY, 1990.

ASME OM Code, Subsection ISTB, *Inservice Testing of Pumps in Light-Water Reactor Power Plants*, Code for Operation and Maintenance of Nuclear Power Plants, The American Society of Mechanical Engineers, New York, NY, 1990.

ASME OM Code, Subsection ISTC, *Inservice Testing of Valves in Light-Water Reactor Power Plants*, Code for Operation and Maintenance of Nuclear Power Plants, The American Society of Mechanical Engineers, New York, NY, 1990.

ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, 1989 Edition, The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY, July 1, 1989.

EPRI NP-5769, *Degradation and Failure of Bolting in Nuclear Power Plants*, Volumes 1 and 2, Electric Power Research Institute, Palo Alto, CA, April 1988.

EPRI TR-102134, *PWR Secondary Water Chemistry Guidelines—Revision 3*, Electric Power Research Institute, Palo Alto, CA, May 1993.

Generic Safety Issue 190, *Fatigue Evaluation of Metal Components for 60-Year Plant Life*, USNRC, September 1995.

IE Bulletin No. 82-02, *Degradation of Threaded Fasteners in the Reactor Coolant Pressure Boundary of PWR Plants*, June 2, 1982.

NRC Bulletin 89-02, *Stress Corrosion Cracking of High-Hardness Type 410 Stainless Steel Internal Preloaded Bolting in Anchor Darling Model S350W Swing Check Valves or Valves of Similar Design*, July 19, 1989.

NRC Generic Letter 88-01, Supplement 1. *NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping*, January 25, 1989.

NRC Generic Letter 88-05, *Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants*, March 17, 1988.

NRC Generic Letter 89-04, *Guidance for Developing Acceptable Inservice Testing Programs*, April 3, 1989.

NRC Generic Letter 89-08, *Erosion/Corrosion-Induced Pipe Wall Thinning*, May 2, 1989.

NRC Generic Letter 90-06, *Resolution of Generic Issue 70, "Power-Operated Relief Valve and Block Valve Reliability ," and Generic Issue 94, "Additional Low-Temperature Overpressure Protection for Light Water Reactors," Pursuant to 10 CFR 50.54(f)*, June 25, 1990.

NRC Generic Letter 91-17, *Generic Safety Issue 79, "Bolting Degradation or Failure in Nuclear Power Plants"*, October 17, 1991.

NRC Generic Letter 96-05, *Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves*, September 18, 1996.

NRC Information Notice 79-19, *Pipe Cracks in Stagnant Borated Water Systems at PWR Plants*, July 17, 1979.

NRC Information Notice 80-37, *Containment Cooler Leaks and Reactor Cavity Flooding at Indian Point Unit 2*, October 24, 1980.

NRC Information Notice 80-38, *Cracking in Charging Pump Casing Cladding*, October 31, 1980.

NRC Information Notice 82-43, *Deficiencies in LWR Air Filtration/Ventilation Systems*, November 16, 1882.

NRC IN 84-18, *Stress Corrosion Cracking in Pressurized Water Reactor Systems*, March 7, 1984.

NRC IN 86-108, Supplement 3, *Degradation of Rector Coolant System Pressure Boundary Resulting from Boric Acid Corrosion*, January 5, 1995.

NRC Information Notice 88-70, *Check Valve Inservice Testing Program Deficiencies*, August 29, 1988.

NRC Information Notice 89-01, *Valve Body Erosion*, January 4, 1989.

NRC Information Notice 89-79, *Degraded Coating and Corrosion of Steel Containment Vessels*, December 1 , 1989.

NRC Information Notice 89-79, Supplement 1, *Degraded Coating and Corrosion of Steel Containment Vessels*, June 29, 1990

NRC Information Notice 90-68, *Stress Corrosion Cracking of Reactor Coolant Pump Bolts*, October 30, 1990.

NRC Information Notice 91-05, *Intergranular Stress Corrosion Cracking in Pressurized Water Reactor Safety Injection Accumulator Nozzles*, January 30, 1991.

NRC Information Notice 93-21, *Summary of NRC Staff Observations Compiled During Engineering Audits or Inspections of Licensee Erosion/Corrosion Programs*, March 25, 1993.

NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casing Caused by Cladding Cracks, August 30, 1994.

NRC Information Notice 96-11, *Ingress of Demineralizer Resin Increases Potential for Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations*, February 14, 1996.

NRC Information Notice 97-19, *Safety Injection System Weld Flaw at Sequoyah Nuclear Power Plant, Unit 2*, April 18, 1997.

NRC Information Notice 98-23, *Crosby Relief Valve Setpoint Drift Problems Caused by Corrosion of the Guide Ring*, June 23, 1998.

NRC Information Notice 98-24, *Stem Binding in Turbine Governor Valves in Reactor Core Isolation Cooling (RCIC) and Auxiliary Feedwater* (AFW) Systems, June 26, 1998.

Regulatory Guide 1.35, *Inservice Inspection of Ungrouted Tendons in Prestressed Concrete Containments* (Draft SC 810-4, Proposed Revision 3, published March 1979).

Regulatory Guide 1.44, *Control of the Use of Sensitized Stainless Steel*, May 1973.

Regulatory Guide 1.52, *Design, Testing, and Maintenance Criteria for Postaccident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants*, March 1978.

Regulatory Guide 1.90, *Inservice Inspection of Prestressed Concrete Containment Structures with Grouted Tendons*, August 1977.

Regulatory Guide 1.136, *Materials, Construction, and Testing of Concrete Containments (Articles CC-1000, -2000, and -4000 through -6000 of the "Code for Concrete Reactor Vessels and Containments")* (Draft SC 814-5, Proposed Revision 2, published November 1979)

NUREG-0313, Revision 2, *Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping*, U.S. Nuclear Regulatory Commission, January 1988.

NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*, Richard E. Johnson, U.S. Nuclear Regulatory Commission, June 1990.

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ASME OM Code, Subsection ISTC, *Inservice Testing of Valves in Light-Water Reactor Power Plants*, Code for Operation and Maintenance of Nuclear Power Plants, The American Society of Mechanical Engineers, New York, NY.

ASME OM S/G, Part 2, *Requirements for Performance Testing of Nuclear Power Plant Closed Cooling Water Systems*, Standards and Guides for Operation and Maintenance of Nuclear Power Plants, The American Society of Mechanical Engineers, New York, NY.

ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, 1989 Edition, The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY, July 1, 1989.

ASTM D95-83, *Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation*, American Society for Testing and Materials, West Conshohocken, PA, 1983.

EPRI NP-5769, *Degradation and Failure of Bolting in Nuclear Power Plants*, Volumes 1 and 2, Electric Power Research Institute, Palo Alto, CA, April 1988.

EPRI TR-102134, *PWR Secondary Water Chemistry Guidelines—Revision 3*, Electric Power Research Institute, Palo Alto, CA, May 1993.

EPRI TR-103515, *BWR Water Chemistry Guidelines-Revision 3, Normal and Hydrogen Water Chemistry*, Electric Power Research Institute, Palo Alto, CA, February 1994.

IE Bulletin No. 82-02, *Degradation of Threaded Fasteners in the Reactor Coolant Pressure Boundary of PWR Plants*, June 2, 1982.

NRC Bulletin 87-01, *Thinning of Pipe Walls in Nuclear Power Plants*, July 9, 1987.

NRC Generic Letter 89-04, *Guidance for Developing Acceptable Inservice Testing Programs*, April 3, 1989.

NRC Generic Letter 89-08, *Erosion/Corrosion-Induced Pipe Wall Thinning*, May 2, 1989.

NRC Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Equipment*, July 18, 1989.

NRC Generic Letter 89-13, Supplement 1, *Service Water System Problems Affecting Safety-Related Equipment*, April 4, 1990.

NRC Generic Letter 90-06, *Resolution of Generic Issue 70, "Power-Operated Relief Valve and Block Valve Reliability ," and Generic Issue 94, "Additional Low-Temperature Overpressure Protection for Light Water Reactors," Pursuant to 10 CFR 50.54(f)*, June 25, 1990.

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NRC Generic Letter 96-05, *Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves*, September 18, 1996.

NRC Information Notice 81-21, *Potential Loss of Direct Access to Ultimate Heat Sink*, July 21, 1981.

NRC Information Notice 85-24, *Failures of Protective Coatings in Pipes and Heat Exchangers*, March 26, 1985.

NRC Information Notice 85-30, *Microbiologically Induced Corrosion of Containment Service Water System*, April 19, 1985.

NRC Information Notice 86-96, *Heat Exchanger Fouling can Cause Inadequate Operability of Service Water Systems*, November 20, 1986.

NRC Information Notice 86-106, *Feedwater Line Break*, December 16, 1986.

NRC Information Notice 86-106, Supplement 1, *Feedwater Line Break*, February 13, 1987.

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NRC Information Notice 86-106, Supplement 3, *Feedwater Line Break*, November 10, 1988.

NRC Information Notice 88-70, *Check Valve Inservice Testing Program Deficiencies*, August 29, 1988.

NRC Information Notice 89-53, *Rupture of Extraction Steam Line on High Pressure Turbine*, June 13, 1989.

NRC Information Notice 91-18, *High-Energy Piping Failures Caused by Wall Thinning*, March 12, 1991.

NRC Information Notice 91-18, Supplement 1, *High-Energy Piping Failures Caused by Wall Thinning*, December 18, 1991.

NRC Information Notice 91-19, *Steam Generator Feedwater Distribution Piping Damage*, March 12, 1991.

NRC Information Notice 91-28, *Cracking in Feedwater System Piping*, April 15, 1991.

NRC Information Notice 92-35, *Higher than Predicted Erosion/Corrosion in Unisolable Reactor Coolant Pressure Boundary Piping inside Containment at a Boiling Water Reactor*, May 6, 1992.

NRC Information Notice 93-21, *Summary of NRC Staff Observations Compiled During Engineering Audits or Inspections of Licensee Erosion/Corrosion Programs*, March 25, 1993.

NRC Information Notice 94-03, *Deficiencies Identified During Service Water System Operational Performance Inspections*, January 11, 1994.

NRC Information Notice 95-11, *Failure of Condensate Piping Because of Erosion/Corrosion at a Flow Straightening Device*, February 24, 1995.

NRC Information Notice 97-84, *Rupture in Extraction Steam Piping as a Result of Flow-Accelerated Corrosion*, December 11, 1997.

NUREG-1344, *Erosion/Corrosion-Induced Pipe Wall Thinning in U.S. Nuclear Power Plants*, P. C. Wu, U.S. Nuclear Regulatory Commission, April 1989.

NUREG-1339, *Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants*, Richard E. Johnson, U.S. Nuclear Regulatory Commission, June 1990.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
V A - 1	Containment Spray System	2.1 through 2.4, 6.1	V A-10		General corrosion, pitting and crevice corrosion are listed as aging mechanisms for carbon steel components in the header and spray nozzles system. Stainless steel (2.1 through 2.4) exposed to air will not be affected by these aging mechanisms. Also, carbon steel exposed to air will be most susceptible to general corrosion; crevice corrosion and pitting require an aqueous environment.
V A - 2	Containment Spray System	1.1 thru 1.3, 1.1, 1.5, 3.1, 4.1, 5.1, 7.1 thru 7.4	V A-4, 6, 10, 14, 16, 18, 20, 24, 26		Control of chemistry for borated water contained in containment spray system is sufficient to manage SCC; pitting and crevice corrosion. Reference to/discussion of ASME Section XI should be deleted from References, AMP and Evaluation and Technical basis section. The **AMP** should be the Chemistry Control Program. No further evaluation is required element 4 of item A.1.1 thru A.1.3, A.1.5, A.4.1, A.5.1.
V A - 3	Containment Spray System	1.1 thru 1.3, 1.1, 4.1, 5.1	V A-5, 7, 15, 17, 19, 21,		Delete discussions in element 2 of the evaluation relative to inadvertent introduction of contaminants and reliance on ISI.
V A - 4	Containment Spray System	1.4, 4.1, 5..2, 7..3 thru 7..5	V A-9, 19, 23, - 29		Relative to the evaluation: Replace "coolant" with fluid in elements 1 and 3. Replace "reactor coolant pressure boundary" with bolting in element 1. Replace "reactor coolant" with fluid in element 2.
V A - 5	Containment Spray System	1.1, 1.5, 3.1, 3.2, 4.1, 5.1	V A-7, 11, 13, 17, 21		Regulatory Guide 1.44 does not manage cracking of stainless steel. This guide provides information to limit the sensitization of stainless steel during welding. However, sensitization of stainless steel during welding cannot be eliminated and it must be assumed that cracking will occur if the other parameters necessary for cracking (i.e., halogens) are present. Therefore, other programs (ex- chemistry) are necessary to manage cracking. Relative to SSC, the references, AMP and Evaluation and Technical Basis should include design and material controls consistent with Reg. Guide 1.43.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
V C - 1	Containment Isolation Components	1.1 thru 1.3; 2.1, 2.2	V C-6		Wear is identified as an aging mechanism. Since there is no relative motion between the hatch surfaces and the containment surface, this aging mechanism should not be considered. This position was accepted in the CCNP SER.
V C - 2	Containment Isolation Components	10.1, 10.2	V C-20		Section does not include MIC an aging mechanism for containment isolation SCs. This aging mechanism would be applicable to any raw water piping penetration the containment.
V C - 3	Containment Isolation Components	5.1 thru 5.3	V C-8		Items 5.1 thru 5.3 indicate that the fuel transfer penetrations are fabricated of carbon steel and are exposed to an environment of air and occasional leaking borated water. While this environment may be correct for the containment side of the penetration most of the time, the containment side of the penetration is fully exposed to borated water during refueling and the spent fuel pool side is fully exposed to borated water at all times. For this reason, these items would be expected to be fabricated of stainless steel and not carbon steel. Additionally, the aging mechanism listed, general corrosion, would not be applicable for penetrations fabricated from stainless steel.
V C - 4	Containment Isolation Components	C.8, C.9, C.10	V C-2, 10 through 21		The Isolation Barriers portions for C.8, C.9 and C.10 should be expanded to include the piping as well as the valves. *(Several systems will scope out of with the exception of containment isolation portions)*
V C - 5	Containment Isolation Components	C.10	V C-2, 20, 21		Expand discussion of lines to cover other lines not specifically in C.8 or C.9. This would best be accomplished by stating "in lines not covered by C.8 or C.9 which includes such systems as fire protection, . . . etc. " Inside Surface should also include air or compressed gas. *(Several systems may scope out of with the exception of containment isolation portions)*
V C - 6	Containment Isolation Components	C.8.1, C.8.2	V C-10, 11		ISI VT-2 examinations are credited, performed at system operating pressures which for these systems is well above post accident containment pressures. A one-time inspection (of valve body & bonnet) is not required to assure the post-accident containment intended function. Such inspection, if required, should be addressed under the individual system (ECCS, Feedwater, Main Steam).

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
V C - 7	Containment Isolation Components	C.8.1, C.8.2	V C-10, 11		ASME Section XI inservice testing is credited. It is not clear how this testing is an appropriate AMP for corrosion of valve bodies and bonnets. As stated under attribute (3), IST confirms "component performance." It does not appear necessary to credit this program here. If it will be necessary for applicants to align credited AMPs with this report, then only those existing programs that are essential to manage aging (of passive components as required by the Rule) should be credited.
V C - 8	Containment Isolation Components	C.8.1, C.8.2	V C-10, 11		10 CFR 50 Appendix J testing is credited. It is not clear how this testing is an appropriate AMP for corrosion of valve bodies and bonnets. Appendix J testing is intended to confirm seat leakage, not integrity of body & bonnet. Even severe wall thinning would not be detected by Appendix J testing methods (low pressure). It does not appear necessary to credit this program here. If it will be necessary for applicants to align credited AMPs with this report, then only those existing programs that are essential to manage aging (of passive components as required by the Rule) should be credited.
V C - 9	Containment Isolation Components	C.8.1, C.8.2	V C-12, 13		10 CFR 50 Appendix J testing is credited. It is not clear how this testing is an appropriate AMP for cracking of valve bodies and bonnets. Appendix J testing is intended to confirm seat leakage, not integrity of body & bonnet. Even a through-wall crack would not likely be detected by Appendix J testing methods (low pressure and allowable leakage acceptance criteria). It does not appear necessary to credit this program here. If it will be necessary for applicants to align credited AMPs with this report, then only those existing programs that are essential to manage aging (of passive components as required by the Rule) should be credited.
V C - 10	Containment Isolation Components	C.10.1, C.10.2	V C-20, 21		This section is for containment isolation valves in non-safety related systems. The GALL report does not evaluate, assuming "plant specific" programs. However, these containment isolation components in non-safety related systems are safety related for containment barrier function and are ASME Class 2, and so should be subject to the same Code required programs as evaluated under C.8.1, C.8.2. These need to be evaluated in the GALL report.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
V C - 11	Containment Isolation Components	C.8.1, C.8.2	V C-10, 11, 12, 13		Control of chemistry is sufficient to manage SCC; pitting and crevice corrosion for inside surface. The **AMP** should be the Chemistry Control Program for inside surface. ISI examinations are sufficient to monitor condition of outside surface. The **AMP** should be the ISI Program for external surface.
V C - 12	Containment Isolation Components	C.9.1, C.9.2	V C-14, 15, 16, 17		Control of chemistry is sufficient to manage SCC; pitting and crevice corrosion for inside surface. The **AMP** should be the Chemistry Control Program for inside surface. ISI examinations are sufficient to monitor condition of outside surface. The **AMP** should be the ISI Program for external surface. No further evaluation is required for element 4 (page 15). No further evaluation is required for element 4 (page 11). Delete reference to/discussion of Appendix J testing.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
V D.1 - 1	Emergency Core Cooling System	1.1.1 thru 1.1.6, 1.1.1 thru 1.1.5, 1.2.1, 1.3.1, 1.4.1, 1.5.1 thru 1.5.4, 1.6.1 thru 1.6.3, 1.7.1 thru 1.7.3, 1.7.3, 1.8.1 thru 1.8.3, 1.8.3,	V D1-4, 6, 12, 14, 16, 20, 22, 24, 28, 30, 32		Control of chemistry for borated water contained in emergency core cooling system is sufficient to manage SCC; pitting and crevice corrosion. Reference to/discussion of ASME Section XI should be deleted from References, AMP and Evaluation and Technical basis section. The **AMP** should be the Chemistry Control Program. No further evaluation is required element 4 of item D.1.1 thru D.1.5, D.1.2.1, D.1.4.1, D1.7.1 thru D.1.7.3, D1.8.1 thru D.1.8.3.
V D.1 - 2	Emergency Core Cooling System	1.1.1 thru 1.1.6, 1.2.1, 1.4.1, 1.7.3, 1.8.3	V D1-4, 14, 20, 30, 32		Regulatory Guide 1.44 does not manage cracking of stainless steel. This guide provides information to limit the sensitization of stainless steel during welding. However, sensitization of stainless steel during welding cannot be eliminated and it must be assumed that cracking will occur if the other parameters necessary for cracking (i.e., halogens) are present. Therefore, other programs (ex- chemistry) are necessary to manage cracking. Relative to SSC, the references, AMP and Evaluation and Technical Basis should include design and material controls consistent with Reg. Guide 1.43.
V D.1 - 3	Emergency Core Cooling System	1.1.7, 1.2.1, 1.2.2, 1.3.2, 1.4.1, 1.4.2, 1.5.3 thru 1.5.5, 1.6.3, 1.6.4, 1.7.1, 1.8.4	V 1-8, 16, 22, 24, 26, 34		Relative to the evaluation: Replace "coolant" with fluid in elements 1 and 3. Replace "reactor coolant pressure boundary" with bolting in element 1. Replace "reactor coolant" with fluid in element 2.
V D.1 - 4	Emergency Core Cooling System	1.1.6	V D1-8		Stagnant, chemically treated water is not expected to have biological activity that would lead to microbiologically influence corrosion

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
V D.1 - 5	Emergency Core Cooling System	Generic			Cast stainless steel should be included as material. If cast austenitic stainless steel is used, operating temperatures continually in excess of 482 F will result in a reduction of fracture toughness; an aging management program needs to be added to these items. *(Refer to item C.2.1.1 thru 2.1.3 on page IV C2-10 for discussion of AMP and include same)*
V D.1 - 6	Emergency Core Cooling System	1.1.1 thru 1.1.6, 1.2.1, 1.4.1, 1.7.3, 1.8.3	V D1-4, 14, 20, 30, 32		Delete discussions in element 2 of the evaluation relative to inadvertent introduction of contaminants and reliance on ISI.
V D.1 - 7	Emergency Core Cooling System	1.5.1 thru 1.5.4	V D1-22		EPRI TR-107396 provides chemistry guidelines for closed cooling water.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
V D2-1	ECCS (BWR)	D2.1.1 Thru D2.1.7	V D2-4		Remove the "or" between LPCI and RHR, and replace it with an "and". Lines to Spent Fuel Pool are not necessarily in scope for LR. Need to define "Oxygenated Water".
V D2-2		D2.1.1 Thru D2.1.7	V D2-5		General comment 1 for ASME Section XI inspections. General comment 2 for NO one time inspections.
V D2-3		D2.1.1	V D2-6 V D2-7		Replace the References and Existing AMP boxes with the boxes for Item E5.1.1 on pages VII E5-4 and 5, which have a more complete description of the fatigue references (includes ASME Section III)
V D2-4		D2.1.1 Thru D2.1.7	V D2-6		Lines to SFP are not necessarily in scope for LR.
V D2-5		D2.1.1 Thru D2.1.7	V D2-7		General comment 1 for ASME Section XI inspections.
V D2-6		D2.1.9 D2.1.10	V D2-9 V D2-11		See generic write-up for Flow Accelerated Corrosion program. Why the reference to NRC IN 93-21 ? What does it accomplish ?
V D2-7		D2.2.1 Thru D2.2.3	V D2-13		General comment 1 for ASME Section XI inspections. General comment 2 for NO one time inspections.
V D2-8		D2.3.1	V D2-15 V D2-17 V D2-19		General comment 1 for ASME Section XI inspections. General comment 2 for NO one time inspections.
V D2-9		D2.4.1 Thru D2.4.4	V D2-18 V D2-19		Need definitions for Oxygenated Water and Treated Water for closed cycle cooling water.
V D2-10		D2.4.1 Thru D2.4.4	V D2-21 V D2-23		The description of the NRC GL 89-13 programs is too specific in its detail to apply to ALL utilities. See generic 89-13 program write-up.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

General Comment 1 : The descriptions of the ASME Section XI testing for system leakage testing and hydrostatic testing and for valve internal inspections is not correct for Class 2 and 3 components. Each utility has NRC approved exemptions and relief from different requirements. Furthermore, BWR VIP-75 is changing the frequencies of the NUREG-0313 and NRC GL 88-01. This needs to be generally described.

General Comment 2 : One time inspections are NOT required. Reasonable assurance of the adequacy of the AMP programs is obtained from the existing programs.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION V

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT/ RESOLUTION
V.E-1	Engineered Safety Features- Fan Cooler System	E.1.1 E.1.5 E.1.6	V E-4		In the Environment column, should not refer to service water as treated water. Water supply is normally from closed cooling water (e.g. component cooling water).
V.E-2	Engineered Safety Features- Fan Cooler System	E1.1	V E-4		Cu-Ni alloy is not susceptible to general corrosion. Delete Item E.1.1.
V.E-3	Engineered Safety Features- Fan Cooler System	E.1.2 E.1.3 E1.4	V E-4		Per 10CFR54.21(a)(1)(i) the listed three items are excluded from the scope of Part 54. NEI 95-10 Rev. 1 also excluded them (see Appendix B, Items 121 and 122). These items do not require aging management and should be removed from the table.
V.E-4	Engineered Safety Features- Fan Cooler System	E.1.5 E.1.6	V E-4		The "Fan Coolers" System does not include normally the piping to the coils, since they are part of the component cooling system or similar water system.
V.E-5	Engineered Safety Features- Fan Cooler System	E.1.5 E.1.6	V E-4		Stainless Steel (SS) is not susceptible to General Corrosion. Therefore, SS should be removed or a separate line item should be created for SS Piping and Fittings.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII A-1	Steam Turbine System	A.1.1 and A.1.2	VIII A-5		The program described to manage loss of material due to erosion-corrosion is a combination of programs and contains more detail than is necessary to demonstrate effectiveness. Only the Flow Accelerated Corrosion Program is required to manage loss of material due to erosion-corrosion. Replace the program description with the revised Flow Accelerated Corrosion Program description that has been provided.
VIII A-2	Steam Turbine System	A.1.1 and A.1.2	VIII A-4		Replace "Erosion/Corrosion (E/C)" with "Flow Accelerated Corrosion (FAC)".

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII B1-1	Main Steam System	B1.1.1 through B1.1.5 and B1.2.1	VIII B1-4 and 6.		Erosion-corrosion is not a concern if the main steam system has superheated steam. The **Aging Mechanism** column needs to no that this mechanism is not a concern for superheated main stea systems.
VIII B1-2	Main Steam System	B1.1.1 through B1.1.5 and B1.2.1	VIII B1-4 and 6.		Replace "Erosion/Corrosion (E/C)" with "Flow Accelerated Cor (FAC)".
VIII B1-3	Main Steam System	B1.1.1 through B1.1.5 and B1.2.1	VII B1-4 and 6.		For those areas not containing superheated steam, the FAC Prog described needs to be replaced with the FAC Program descriptio has been provided. The current program description is a mixtur two programs and contains more detail than is necessary to sho the FAC Program is effective in managing flow accelerated corr

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VIII B2-1	Steam and Power Conversion Systems Main Steam System (BWR)	All			The GALL report treats containment isolation valves in safety related systems under the containment barrier section. It is more appropriate to treat these valves with their associated safety related system.
VIII B2-2	Steam and Power Conversion Systems Main Steam System (BWR)	B2.1.1 through B2.1.6	VIII B2-4, 5		The described preventive actions (except water chemistry) are generally not implemented until a problem location has been identified.
VIII B2-3	Steam and Power Conversion Systems Main Steam System (BWR)	B2.1.1 through B2.1.6	VIII B2-4, 5		Element 3 under "Evaluation and Technical Basis" column is essentially a description of the initial baseline inspection which is completed for all plants. This description is not applicable to the ongoing E/C Monitoring program. The discussion under element 5 is also applicable to the initial inspection only, and not relevant for ongoing AMP. E?C program should be called Flow Assisted Corrosion (FAC) program, see generic program description.
VIII B2-4	Steam and Power Conversion Systems Main Steam System (BWR)	B2.2.1	VIII B2-8, 9		The identified operating experience is not relevant to license renewal, i.e., IST program scope for check valve reverse flow testing (active function). See generic issue list.
VIII B2-5	Steam and Power Conversion Systems Main Steam System (BWR)	B2.2.1	VIII B2-8, 9		ASME Section XI inservice testing is credited. It is not clear how this testing is an appropriate AMP for corrosion of valve bodies and bonnets. As stated under attribute (3), IST confirms "component performance." It does not appear necessary to credit this program here. If it will be necessary for applicants to align credited AMPs with this report, then only those existing programs that are essential to manage aging (of passive components as required by the Rule) should be credited. See generic issue list.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII B2-6	Steam and Power Conversion Systems Main Steam System (BWR)	B2.2.1	VIII B2-8, 9		Generic Letter 90-06 is not applicable to Boiling Water Reactors, and should not be referenced or discussed in this section.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT/ RESOLUTION
VIII C - 1	Extraction Steam System	ALL	Various		The Extraction Steam System does not perform any Intended Function per 10CFR 54.4 for PWR's. Delete references to PWR.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII D1-1	Steam and Power Conversion Feedwater (PWR)	D1.3	VIII D1-1, 3, 8 and 9		Feedwater Pumps are typically not required for safe shutdown or accident mitigation. The Auxiliary Feedwater System serves the safe shutdown or accident mitigation functions of secondary inventory control. Delete D1.3 and its subsections D1.3.1 and D1.3.2.
VIII D1-2	Steam and Power Conversion Feedwater (PWR)	D1.1.1	VIII D1-6, 7, 8 & 9		The **AMP** for General, Crevice and Pitting Corrosion of Piping and Fittings should be the Chemistry Control Program that is based on EPRI TR-102134. This program should not require 'one time inspections' as listed in program element 4 (Detection of Aging Effects) in the **'Evaluation and Technical Basis'** column. There should be no action listed in the **'Further Evaluation'** column. Refer to AMA titled *'Chemistry Program (Secondary)'* in lieu of existing listed program.
VIII D1-3	Steam and Power Conversion Feedwater (PWR)	D1.2.1	VIII D1-8 and 9		General, Crevice and Pitting Corrosion of Valve Bodies references the Piping and Fitting **'AMP'** and **'Evaluation and Technical Basis'**. (D1.2.1 to be 'Valve body and Bonnet' instead of 'Valve Bodies'.) The **AMP** should be the Chemistry Control Program that is based on EPRI TR-102134. This program should not require 'one time inspections' as listed in program element 4 (Detection of Aging Effects) in **'Evaluation and Technical Basis'** column. There should be no action listed in the **'Further Evaluation'** column. Refer to AMA titled *'Chemistry Program (Secondary)'* in lieu of existing listed program.

NOTES: 1. This comment has generic implications regarding other sections of the GALL Report.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT/ RESOLUTION
VIII E – 1	Condensate System	E.1.1	VIII E-5		The program described to manage loss of material due to erosion-corrosion is a combination of programs and contains more detail than is necessary to demonstrate effectiveness. Only the Flow Accelerated Corrosion Program is required to manage loss of material due to erosion-corrosion. Replace the program description with the revised "*Flow Accelerated Corrosion Program*" description that has been provided. Hence, further evaluation is not warranted
VIII E – 2	Condensate System	E.2.1	VIII E-6		Valve bodies made of stainless steel are called out as susceptible to erosion-corrosion, whereas it is generally accepted that SS is relatively immune to E/C. Delete stainless steel from material column.
VIII E – 3	Condensate System	E.4.1 thru E.4.4	VIII E-7 VIII E-11		Use of Chemistry will preclude loss of material due to corrosion in the Condensate System. Replace the program description with the revised "*Secondary Water Chemistry Program*" description that has been provided.. Hence, further evaluation is not warranted.
VIII E – 4	Condensate System	E.5.1	VIII E-10		Stainless Steel (SS) is not susceptible to general corrosion. Therefore, a separate line item should be created for SS Condensate Storage Tanks. The aging effects would be pitting and crevice corrosion. The AMA would be a plant specific activity based on plant design and management philosphy. Hence, further evaluation is warranted.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT/ RESOLUTION
VIII F - 1	Steam Generator Blowdown System	F.1.1, F.1.2, F.2.1	VIII F-5 VIII F-9		The program described to manage loss of material due to erosion-corrosion is a combination of programs and contains more detail than is necessary to demonstrate effectiveness. Only the Flow Accelerated Corrosion Program is required to manage loss of material due to erosion-corrosion. Replace the program description with the revised "*Flow Accelerated Corrosion Program*" description that has been provided.
VIII F - 2	Steam Generator Blowdown System	F.1.1, F.1.2, F.2.1,	VIII F-7 various		Use of Chemistry will preclude loss of material due to corrosion in the Steam Generator Blowdown System. Replace the program description with the revised "*Secondary Water Chemistry Program*" description that has been provided.. Hence, further evaluation is not warranted.
VIII F - 3	Steam Generator Blowdown System	F.3.1, F.4.1, F.4.2, F.4.3	VIII F-8, F-9,F-10, various		Eliminate Blowdown Pump and Blowdown Heat Exchanger Items; these components do not support a License Renewal intended function.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII G-1	Auxiliary Feedwater (AFW) System (PWR)	G.1.1	VIII G-4 Through 7		Erosion/ Corrosion (should be 'Flow Accelerated Corrosion') is not a valid Aging Mechanism and should be deleted from the Auxiliary Feedwater System. Auxiliary Feed does not meet the criteria for Flow Accelerated Corrosion monitoring in accordance with the EPRI guidelines. Industry experience indicates that erosion corrosion is not plausible for cold water systems control and infrequent operation. Therefore, Flow Accelerated Corrosion is not plausible for this piping and this entry should be removed. This position was accepted in the CCNPP SER.
VIII G-2	Steam and Power Conversion Auxiliary Feedwater (PWR)	G.1.1 & 2, G.2.1 & 2, G.3.1 and G.4.1	VIII G-6 Through 15		The Evaluation for General corrosion is crediting control of chemistry as the sole Aging Management Program. Many plants do not (or can not) control oxygen in their Condensate Storage Tanks. Additionally the Auxiliary Feedwater Systems normally have a connection to a raw water system for a backup water source. Remove references to control of Oxygen. Refer to AMA titled *'Chemistry Program (Secondary)'* in lieu of existing listed program.
VIII G-3	Auxiliary Feedwater (AFW) System (PWR)	G.1.1, G.1.2 and G.3.1	VIII G-6 and 14		Crevice Corrosion/Pitting are the only Aging Mechanisms listed for Carbon Steel Valves but General Corrosion, Crevice Corrosion/Pitting are all listed for CS Piping. This appears to be inconsistent.
VIII G-4	Auxiliary Feedwater (AFW) System (PWR)	G.1.2	VIII G-8 and 9		General Corrosion, Galvanic Corrosion, and MIC are listed as Aging Mechanisms for Aux Feedwater Buried Piping. Coatings, wrapping, and cathodic protection are listed as existing AMPs for buried piping. Coatings, wrapping, and cathodic protection are not AMPs but are design features. Coatings, wrapping, and cathodic protection should be removed from the entry.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII G-5	Auxiliary Feedwater (AFW) System (PWR)	G.2.1, G.2.2 and G.3.1	VIII G-10, 11, 14 and 15		Crevice Corrosion/Pitting are listed as Aging Mechanisms for AFW Pump and Valves. Chemistry Program and ISI/IST are considered adequate for management of these Aging Mechanisms, but in other sections (VII.E1, VII.E4) with the same Aging Mechanisms, ISI/IST was not considered adequate and a supplemental or one-time inspection was suggested instead. In fact, earlier in this same section (VIII.G.1.1, VIII.G.1.2, General Corrosion, CC/Pitting (AFW Piping)), for the same Aging Mechanisms, the combination of the Chemistry Program and a one-time inspection (potentially consisting of ultrasonic and surface techniques) was suggested. Why is an external visual inspection adequate for the pump/valves in this case but not for the other pipes? Also, performance testing of a pump/valve under IST would not necessarily indicate the condition of the pressure boundary; performance testing would primarily apply to the active intended functions. Only the chemistry program should be referenced. Refer to AMA titled *'Chemistry Program (Secondary)'* in lieu of existing listed program.
VIII G-6	Auxiliary Feedwater (AFW) System (PWR)	G.2.1 and G.2.3	VIII G-12 and 13		General Corrosion is listed as an Aging Mechanism for the AFW Pump Casing & Bolting. (This mechanism was considered Not Plausible for CCNPP; see separate comments on the Aging Mechanism elsewhere. Comments to follow assume that the Aging Mechanism is retained in Report Despite earlier comment.) For the stated Aging Mechanism/Aging Effect combination General Corrosion/Loss of Material, much of the discussion in the **'Evaluation and Technical Basis'** revolves around managing an Aging Effect of 'cracking'. General Corrosion manifests itself as a gross wastage (loss of material) and not as cracking. The AMP/Evaluation and Technical Basis does not follow from the Aging Mechanism/Aging Effect information.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII G-7	Auxiliary Feedwater (AFW) System (PWR)	G.4.1	VIII G-16 and 17		The Condensate Storage Tank is listed as being fabricated of stainless steel, whereas the AFW system piping is carbon steel. Many plants have Condensate Storage Tanks may of carbon steel with a coating to prevent corrosion.
VIII G-8	Auxiliary Feedwater (AFW) System (PWR)	G.4.1	VIII G-16 and 17		General Corrosion, Crevice Corrosion, and Pitting are listed as Aging Mechanisms for the Condensate Storage Tank. This entry refers back to an entry for the same Aging Mechanisms for the AFW system piping. The Condensate Storage Tank is listed as being fabricated of stainless steel, whereas the AFW system piping is carbon steel. Stainless steel is not susceptible to General Corrosion. Crevice Corrosion and Pitting are not plausible for the stainless steel tank due to chemistry control and the low temperatures (outside ambient) involved. None of these Aging Mechanisms should be listed for this entry. This position was accepted in the CCNPP SER.

GALL REPORT – MECHANICAL DISCILPLINE COMMENTS
SECTION VIII

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VIII G-9	Auxiliary Feedwater (AFW) System (PWR)	G.5.1 through G.5.3	VIII G-16, 17, 18 and 19		General Corrosion and MIC are listed as Aging Mechanisms for the AFW Pump Turbine Bearing Oil Coolers. 'Appropriate materials and lining/coating' are listed as existing AMPs for AFW Pump Turbine Bearing Oil Coolers. Appropriate materials and lining/coating are not AMPs but are design features. These items should be removed from the entry. For the stated Aging Mechanism/Aging Effect combination General Corrosion & MIC/Loss of Material, much of the discussion in the **'Evaluation and Technical Basis'** revolves around managing 'fouling' or 'biofouling'. In these areas, the AMP/Evaluation and Technical Basis does not follow from the Aging Mechanism/Aging Effect information. This information should be moved to the next entry or the entries should be combined. Also, performance testing under IST would not necessarily indicate the condition of the pressure boundary; performance testing would primarily apply to the active intended functions. Chemistry Program and surveillance of leakage testing are considered adequate for management of these Aging Mechanisms, but in other sections (VII.E1, VII.E4) with the same Aging Mechanisms, an external visual inspection was not considered adequate and a supplemental or one-time inspection was suggested instead. In fact, earlier in this same section (VIII.G.1.1, VIII.G.1.2, General Corrosion, CC/Pitting (AFW Piping)), for the same Aging Mechanisms, the combination of the Chemistry Program and a one-time inspection (potentially consisting of ultrasonic and surface techniques) was suggested. Why is an external visual inspection adequate for the Bearing Oil Cooler in this case but not for the other pipes?

NOTES: 1. This comment has generic implications regarding other sections of the GALL Report.

MARK UA
8/24

CHAPTER VIII
(10/15/99)

STEAM AND POWER CONVERSION SYSTEM

Major Plant Sections

A. Steam Turbine System

B1. Main Steam System (PWR)

B2. Main Steam System (BWR)

C. Extraction Steam System

D1. Feedwater Systems (PWR)

D2. Feedwater Systems (BWR)

E. Condensate System

F. Steam Generator Blowdown System (PWR)

G. Auxiliary Feedwater (AFW) System (PWR)

A. Steam Turbine System

A.1 Piping and Fittings

A.1.1 HP Turbine to MSR

A.1.2 MSR to LP Turbine

A Steam Turbine System

System, Structures, and Components

The system, structures, and components included in this table comprise the piping and fittings in steam turbine system for both pressurized water reactors (PWRs) and boiling water reactors (BWRs) and consist of lines from the high-pressure turbine to the moisture separator/reheater (MSR) and from MSR to low-pressure turbine. All components in the steam turbine system are classified as Group D Quality Standards.

The steam turbine is an active component and should be covered by the plant maintenance program. Any elastomer/rubber expansion joints between the turbine and main condenser should also be covered as a part of the plant maintenance program.

System Interfaces

The systems that interface with the steam turbine system include the main steam system (Tables VIII B1 and B2), steam extraction system (Table VIII C), and condensate system (Table VIII E).

VIII STEAM AND POWER CONVERSION SYSTEMS

A. STEAM TURBINE SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A.1.1. A.1.2	Piping and Fittings	Piping from HP Turbine to MSR. Piping from MSR to LP Turbine	CS	Steam	Wall Thinning	~~Erosion/ Corrosion (E/C)~~ FLOW ACCELERATED CORROSION (FAC) VIII A-2	NUREG-1344. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-103515. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS

A. STEAM TURBINE SYSTEM

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

VIII STEAM AND POWER CONVERSION SYSTEMS
A. STEAM TURBINE SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 for single-phase lines and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for water chemistry in BWRs (TR-103515) and secondary water chemistry in PWRs (TR-102134 Rev. 3)	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters, or selection of materials resistant to E/C. ***(8 & 9) Confirmation Process and***	No

SEE VIII A-1 FLOW ACCELERATED CORROSION PROGRAM (SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR FLOW ACCELERATED CORROSION PROGRAM.

VIII STEAM AND POWER CONVERSION SYSTEMS

A. STEAM TURBINE SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in two-phase piping have occurred in extraction steam lines (INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (INs 89-53, 91-18, 92-21, 97-84). The AMP outlined in NUREG-1344 and its report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	

B1. Main Steam System (PWR)

B1.1 Piping and Fittings

B1.1.1 Steam Lines to Main Turbine

B1.1.2 Lines to FW and AFW Pump Turbines

B1.1.3 Lines to Moisture Separator/Reheater

B1.1.4 Turbine Bypass

B1.1.5 Steam Drains

B1.2 Valves (Check, Control, Hand, Motor Operated Valves)

B1.2.1 Body

VIII STEAM AND POWER CONVERSION SYSTEMS

B1. MAIN STEAM SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B1.1.1 thru B1.1.5	Piping and Fittings	Steam Lines to Main Turbine, Lines to FW and AFW Pump Turbines, Lines to Moisture Separator/ Reheater, Turbine Bypass, Steam Drains	Carbon Steel (CS)	320°C Steam	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-102134 Rev. 3.

SEE VIII B1-1 *INSERT FAC (B1-2)

B1. Main Steam System (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the main steam system for pressurized water reactors (PWRs) extending from the outermost containment isolation valve to the steam turbine, including turbine bypass to condenser, lines to main feedwater (FW) and auxiliary feedwater (AFW) pump turbines, and steam drains. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the main steam system are classified as Group D Quality Standards. The portion of the main steam system extending from the steam generator up to the second isolation valve outside the containment is classified as Group B or C and is covered in Tables IV D1 and D2. The aging management program for isolation valves in the main steam system is reviewed in Table V C.

The valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the main steam system include the steam generator (Tables IV D1 and D2), steam turbine system (Table VIII A), feedwater system (Table VIII D1), condensate system (Table VIII E), and auxiliary feedwater system (Table VIII G).

VIII STEAM AND POWER CONVERSION SYSTEMS

B1. MAIN STEAM SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B1.2.1	Valves (Check Valves, Control Valves, Hand Valves, Motor Operated Valves)	Body	CS	320°C Steam	Wall Thinning	E/C	NUREG-1344. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-102134 Rev. 3.

SEE VIII B1-1 B1-2

VIII STEAM AND POWER CONVERSION SYSTEMS
B1. MAIN STEAM SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 for single phase lines and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for secondary water chemistry (TR-102134, Rev. 3).	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters, or selection of materials resistant to E/C.	No

SEE VIII B1-3

VIII STEAM AND POWER CONVERSION SYSTEMS

B1. MAIN STEAM SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in two-phase piping have occurred in extraction steam lines (INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (INs 89-53, 91-18, 93-21, 97-84). The AMP outlined in NUREG-1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
Same as effect of erosion/corrosion on the piping and fittings in the steam lines to main turbine (B1.1.1), lines to FW and AFW pump turbines (B1.1.2), lines to moisture separator/reheater (B1.1.3), turbine bypass (B1.1.4), and steam drains (B1.1.5).	*Same as effect of erosion/corrosion on the piping and fittings in the steam lines to main turbine (B1.1.1), lines to FW and AFW pump turbines (B1.1.2), lines to moisture separator/reheater (B1.1.3), turbine bypass (B1.1.4), and steam drains (B1.1.5).*	No

SEE VIII B1-3

B2. Main Steam System (BWR)

B2.1 Piping and Fittings

B2.1.1 Steam Lines to Main Turbine (Group B)

B2.1.2 Steam Lines to Main Turbine (Group D)

B2.1.3 Lines to FW Pump Turbines

B2.1.4 Lines to Moisture Separator/Reheater

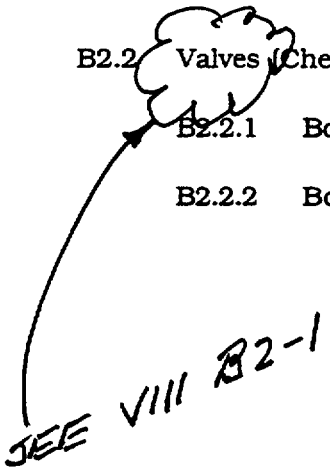
B2.1.5 Turbine Bypass

B2.1.6 Steam Drains

B2.2 Valves (Check, Control, Hand, Motor-Operated Valves)

B2.2.1 Body

B2.2.2 Bolting



VIII STEAM AND POWER CONVERSION SYSTEMS
B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B2.1.1 thru B2.1.6	Piping and Fittings	Steam Lines to Main Turbine (Group B), Steam Lines to Main Turbine (Group D), Lines to FW Pump Turbines, Lines to Moisture Separator/ Reheater, Turbine Bypass, Steam Drains	Carbon Steel (CS)	288°C Steam	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-103515.

SEE VIII B2-3

B2. Main Steam System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the main steam system for boiling water reactors (BWRs) extending from the outermost containment isolation valve to the steam turbines, including turbine bypass to condenser, lines to main feedwater (FW) pump turbines, and steam drains. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," portions of the main steam system extending from the outermost containment isolation valve up to and including the turbine stop and bypass valves, and connected piping up to and including the first valve that is either normally closed or capable of automatic closure during all modes of normal reactor operation, are classified as Group B Quality Standards and the remainder as Group D. For BWRs containing a shutoff valve in addition to the two containment isolation valves in the main steam line, Group B standards are applied to only those portions of the system extending from the outermost containment isolation valves up to and including the shutoff valve. Portion of the main steam system extending from the reactor pressure vessel up to the second isolation valve outside the containment is classified as Group A standards and is covered in Table IV C1. The aging management program for isolation valves in the main steam system is reviewed in Table V C.

The valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the main steam system include the reactor coolant pressure boundary (Table IV C1), steam turbine system (Table VIII A), feedwater system (Table VIII D2), and condensate system (Table VIII E).

VIII STEAM AND POWER CONVERSION SYSTEMS

B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B2.1.1	Piping and Fittings	Steam Lines to Main Turbine (Group B)	CS	288°C Steam	Loss of Material	General, Crevice, and Pitting Corrosion	ASME Section XI, 1989 Edition.

VIII STEAM AND POWER CONVERSION SYSTEMS
B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 for single phase lines and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for water chemistry in BWRs (TR-103515).	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters, or selection of materials resistant to E/C.	No

SEE VIII B2-2

SEE VIII B2-3

VIII STEAM AND POWER CONVERSION SYSTEMS
B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B2.2.1	Valves (Check, Control, Hand, and Motor Operated Valves)	Body	CS	288°C Steam	Wall Thinning	E/C	NUREG-1344. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-103515.
B2.2.1	Valves (Group B) (Check, Control, Hand, and Motor Operated Valves)	Body	CS	288°C Steam	Loss of Material	General, Crevice, and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Appendix I and Subsection ISTC. NRC GL 89-04. ~~NRC GL 90-05.~~ NRC GL 96-05. NRC IN 88-70. EPRI TR-103515.

VIII STEAM AND POWER CONVERSION SYSTEMS
B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in two-phase piping have occurred in extraction steam lines (INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (INs 89-53, 91-18, 93-21, 97-84). The AMP outlined in NUREG-1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
The program includes preventive measures to mitigate crevice corrosion and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components.	***(1) Scope of Program:*** The program relies on preventive measures to mitigate general, crevice, or pitting corrosion, and inservice inspection (ISI) to monitor the effects of corrosion on the intended function of the main steam system components. ***(2) Preventive Actions:*** Mitigation is by adjusting water chemistry and operating conditions. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by detection of coolant leakage by inservice inspection (ISI). Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 2 components up to the first normally closed valve, according to Table IWC 2500-1 category C-H. ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion can not occur without leakage of coolant; extent and schedule of inspection assure detection of leakage before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI should provide for timely detection of leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWC-3516. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related problem has been reported for piping and fittings in BWR main steam system.	No

VIII STEAM AND POWER CONVERSION SYSTEMS
B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
B2.2.2	Valves (Group B) (Check, Control, Hand, and Motor Operated Valves)	Closure Bolting	High-strength Low-alloy Steel	Air	Attrition	Wear	NUREG-1339. EPRI NP-5769. NRC GL 91-17. NRC IEB 82-02. ASME Section XI, 1989 Edition.

VIII STEAM AND POWER CONVERSION SYSTEMS
B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as effect of erosion/corrosion on the piping and fittings in the steam lines to main turbine (B2.1.1 and B2.1.2), lines to FW pump turbines (B2.1.3), lines to moisture separator/reheater (B2.1.4), turbine bypass (B2.1.5), and steam drains (B2.1.6).	*Same as effect of erosion/corrosion and water chemistry on the piping and fittings in the steam lines to main turbine (B2.1.1 and B2.1.2), lines to FW pump turbines (B2.1.3), lines to moisture separator/reheater (B2.1.4), turbine bypass (B2.1.5), and steam drains (B2.1.6).*	No
For valves classified as Group B Quality Standards inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Subsection IWC, Table IWC 2500-1, testing category C-H for system leakage; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 valves, and additional staff guidelines of NRC Generic Letter (GL) 89-04 regarding the scope of inservice testing (IST), NRC Information Notice (IN) 88-70 regarding scope and testing of safety-related check valves, and GL 96-05 regarding safety-related motor-operated valves, IST is performed in accordance with ASME Subsection IWV (Operation and Maintenance Code Appendix I and Subsection ISTC), to ensure that the changes in design-basis performance of safety-related valves resulting from degradation can be identified and managed. Furthermore, resolution of Generic Issue 70 delineated in NRC GL 90-06 requires power-operated relief valves and block valves be included within the scope of IST in accordance with ASME Subsection IWV. Also, water chemistry program based on EPRI guidelines for water chemistry in BWRs (TR-103515).	***(1) Scope of Program:*** The program relies on inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of Class 2 valves in the main steam system. ***(2) Preventive Actions:*** Mitigation is by adjusting water chemistry (EPRI TR-103515) and operating conditions. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of corrosion by ISI to detect leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 valves in accordance with Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 2 valves and additional guidelines of NRC GLs 89-04 and 96-05, and IN 88-70, IST is performed in accordance with ASME Subsection IWV (OM Code Appendix I and Subsection ISTC). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage or degradation of component performance; extent and schedule of ISI/IST assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** ISI/IST schedule of ASME Section XI should provide for timely detection of corrosion. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWC-3516 for Class 2 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Inspections of check valve by NRC staff have revealed potential problems in the IST programs, e.g., check valves located in the steam supply lines to turbine-driven pumps were not included in the IST program and no reverse-flow operability tests were being performed on check valves other than those used for containment isolation (IN 88-70).	No

SEE VIII B2-b

SEE VIII B2-4 VIII B2-5

VIII STEAM AND POWER CONVERSION SYSTEMS

B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

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

VIII STEAM AND POWER CONVERSION SYSTEMS
B2. MAIN STEAM SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Recommendations for a comprehensive bolting integrity program delineated in NUREG–1339 on resolution of Generic Safety Issue 29 and implemented through NRC Generic Letter 91-17; additional details on bolting integrity outlined in EPRI NP-5769. For valves classified as Group B Quality Standards inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Subsection IWC, Table IWC 2500-1, examination categories C-D for pressure retaining bolting and testing category C-H for system leakage;	***(1) Scope of Program:*** The staff guidance of NRC Generic Letter (GL) 91-17 provides assurances that plant specific comprehensive bolting integrity programs have been implemented to ensure bolting reliability. The NRC staff recommendations and guidelines for a comprehensive bolting integrity program is delineated in NUREG-1339, and the industry's technical basis for the program is outlined in EPRI NP-5769. ***(2) Preventive Actions:*** Selection of bolting material and the use of lubricants and sealants in accordance with guidelines of EPRI NP-5769 and additional requirements of NUREG 1339, prevent or mitigate degradation and failure of all safety-related closure bolting. ***(3) Parameter Monitored/ Inspected:*** The AMP monitors the effects of aging degradation on the intended function of closure bolting by detection of leakage, and by detection and sizing of cracks by inservice inspection (ISI). Inspection requirements of ASME Section XI, Table IWC 2500-1, examination category C-D for pressure retaining bolting greater than 2 in. in diameter specify volumetric examination of the entire length of bolts. However, because most failures have occurred in fasteners 2 in. or smaller, based on Information and Enforcement Bulletin (IEB) 82-02, enhanced inspection and improved techniques are recommended. These examinations may be conducted on one valve among a group of valves with similar design and performing similar functions in the system. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, and additional requirements of EPRI NP-5769. Requirements of Table IWC 2500-1 category C-H specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 valves. ***(4) Detection of Aging Effects:*** Degradation of the closure bolting can not occur without crack initiation. Also, loss of prestress or attrition of the closure bolting would result in leakage. The extent and schedule of inspection assure detection of aging degradation before the loss of intended function of closure bolting. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI are effective and adequate for timely detection of cracks and leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test is conducted at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any cracks in closure bolting are evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3513. ***(7) Corrective Actions:*** Repair and replacement is in accordance with guidelines and recommendations of EPRI NP-5769. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** The bolting integrity	No

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) programs developed and implemented in accordance with commitments made in response to NRC communications on bolting events have provided effective means of ensuring bolting reliability.	

C. Extraction Steam System

C.1 Piping and Fittings

C.1.1 Lines to Feedwater Heaters

C.1.2 Steam Drains

C.2 Valves

C.2.1 Body

VIII STEAM AND POWER CONVERSION SYSTEM
C. Extraction Steam System

System, Structures, and Components

The system, structures, and components included in this table comprise the extraction steam lines for both pressurized water reactors (PWRs) and boiling water reactors (BWRs) extending from the steam turbine to feedwater heaters, including the drain lines. All components in the extraction steam system are classified as Group D Quality Standards.

The valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the extraction steam system include the steam turbine system (Table VIII A), feedwater system (Tables VIII D1 and D2), and condensate system (Table VIII E).

DELETE FOR PWR VIII C-1

VIII STEAM AND POWER CONVERSION SYSTEMS

C. EXTRACTION STEAM SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.1.1, C.1.2	Piping and Fittings	Lines to Feedwater Heaters, Steam Drains	Carbon Steel (CS)	320°C Steam	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-102134 Rev. 3.

JEE VIII C-1

VIII STEAM AND POWER CONVERSION SYSTEMS

C. EXTRACTION STEAM SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C.2.1	Valves	Body	CS	Steam	Wall Thinning	Erosion/ Corrosion	NUREG-1344. NRC GL 89-08. NRC IN 89-53. NRC IN 91-18. NRC IN 91-18 S1. NRC IN 93-21. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS

C. EXTRACTION STEAM SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 for single phase lines and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for secondary water chemistry in PWRs (TR-102134, Rev. 3).	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG–1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters, or selection of materials resistant to E/C.	No

VIII STEAM AND POWER CONVERSION SYSTEMS

C. EXTRACTION STEAM SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in two-phase piping have occurred in extraction steam lines (INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (INs 89-53, 91-18, 93-21, 97-84). The AMP outlined in NUREG-1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
Same as effect of erosion/corrosion on the piping and fittings in the steam lines to feedwater heaters (C.1.1) and steam drains (C.1.2).	*Same as effect of erosion/corrosion on the piping and fittings in the steam lines to feedwater heaters (C.1.1) and steam drains (C.1.2).*	No

D1. Feedwater Systems (PWR)

D1.1 Main Feedwater Line

D1.1.1 Pipe and Fittings

D1.2 Valves (Control, Check, and Hand Valves)

D1.2.1 Body

D1.3 Feedwater Pump (Steam Turbine- and Motor-Driven)

D1.3.1 Casing

D1.3.2 Suction and Discharge Lines

VIII STEAM AND POWER CONVERSION SYSTEMS

D1. FEEDWATER SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.1.1	Main Feedwater Line	Piping and Fittings	Carbon Steel (CS)	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. NRC BI 87-01. NRC GL 89-08. NRC IN 91-28. NRC IN 92-35. NRC IN 93-21. NRC IN 95-11. EPRI NSAC-202L-R2. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEM
D1. Feedwater System (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the main feedwater system for pressurized water reactors (PWRs) extending from the condensate system to the outermost feedwater isolation valve on the feedwater lines to the steam generator, and consist of the main feedwater lines, feedwater pumps, and valves. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the feedwater system are classified as Group D Quality Standards. Portion of the feedwater system extending from the secondary side of the steam generator up to the second isolation valve outside the containment is classified as Group B or C standards and is covered in Tables IV D1 and D2. The aging management program for isolation valves in the feedwater system is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the feedwater system include the steam generator (Table IV D1 and D2), main steam system (Table VIII B1), extraction steam system (Table VIII C), condensate system (Table VIII E), and auxiliary feedwater system (Table VIII G).

VIII STEAM AND POWER CONVERSION SYSTEMS

D1. FEEDWATER SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
D1.1.1	Main Feedwater Line	Piping and Fittings	Carbon Steel (CS)	Treated water	Loss of Material	General, Crevice, and Pitting, Corrosion	EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS

D1. FEEDWATER SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for secondary water chemistry in PWRs (TR-102134, Rev. 3).	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters, or selection of materials resistant to E/C. ***(8 & 9) Confirmation Process and Administrative***	No

VIII STEAM AND POWER CONVERSION SYSTEMS

D1. FEEDWATER SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D1.2.1	~~Valves (Control, Check, and Hand Valves)~~	Body	Stainless Steel (SS), Carbon Steel (CS)	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D1.1.1).*
D1.2.1	~~Valves (Control, Check, and Hand Valves)~~	Body	Stainless Steel (SS), Carbon Steel (CS)	Treated water	Loss of Material	General, Crevice, and Pitting, Corrosion	EPRI TR-102134 Rev. 3.
D1.3.1, D1.3.2	Feedwater Pump (Steam Turbine- and Motor-Driven)	Casing, Suction and Discharge Lines	Casing: SS, Suction & Discharge Lines: CS	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D1.1.1).*
D1.3.1, D1.3.2	Feedwater Pump (Steam Turbine- and Motor-Driven)	Casing, Suction and Discharge Lines	Casing: SS, Suction & Discharge Lines: CS	Treated water	Loss of Material	General, Crevice, and Pitting, Corrosion	EPRI TR-102134 Rev. 3.

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VALVE BODY AND BONNET VIII D1-3

DELETE PER VIII D1-1

VIII STEAM AND POWER CONVERSION SYSTEMS
D1. FEEDWATER SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in single-phase systems have occurred in feedwater and condensate systems (NRC Bulletin No. 87-01, INs 81-28, 92-35, 95-11). The AMP outlined in NUREG-1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
~~The program relies on preventive measures to mitigate corrosion by monitoring and control of water chemistry in accordance with the EPRI guidelines of TR-102134, Rev. 3.~~ CHEMISTRY PROGRAM (SECONDARY) VIII D1-2 (SEE CHAPTER #11)	~~(1) Scope of Program: The program relies on monitoring~~ and control of water chemistry (EPRI TR 102134 Rev. 3) for managing the effects of loss of material due to general, crevice, or pitting corrosion. ***(2) Preventive Actions:*** Stringent control of system water chemistry by frequent monitoring and timely corrective action when specified impurity levels are exceeded prevent or mitigate corrosion. The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions for control of secondary and demineralized water chemistry. ***(3) Parameters Monitored/Inspected:*** The parameters monitored are the water pH and concentration of corrosive impurities (chlorides, sulfates, dissolved oxygen, sodium, silica). ***(4) Detection of Aging Effects:*** ~~Inspection of~~ representative sample of the system population and most susceptible locations in the system should be conducted to verify effectiveness of the chemistry control program and to ensure that significant degradation is not occurring or that it would not affect the CLB and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, ~~time of service, and lowest design margin.~~ Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, or any other formal program approved by the NRC. ***(5) Monitoring and Trending:*** The frequency of sampling water chemistry varies from continuous, daily, weekly, or as required based on plant operating conditions. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions. ***(6) Acceptance Criteria:*** Maximum levels for various impurities are specified. Any evidence of the presence of an aging effect or unacceptable results is evaluated. ***(7) Corrective Actions:*** When measured water chemistry parameters are outside the specified range, corrective actions are taken which may vary from simple manipulations to bring the parameter back within the	~~Yes, Element 4 should be further evaluated~~ NO SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE SECONDARY CHEMISTRY PROGRAM!

VIII STEAM AND POWER CONVERSION SYSTEMS

D1. FEEDWATER SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) specified value to unit shut down in more extreme cases. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related problem has been reported for feedwater system components in PWRs.	
Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D1.1.1).	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D1.1.1).*	No
~~*Same as effect of General, Crevice, and Pitting, Corrosion on the piping and fittings in the main feedwater lines (D1.1.1).*~~	*Same as effect of General, Crevice, and Pitting, Corrosion on the piping and fittings in the main feedwater lines (D1.1.1).*	~~Yes, Element 4 should be further evaluated.~~
Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D1.1.1).	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D1.1.1).*	No
Same as effect of General, Crevice, and Pitting, Corrosion on the piping and fittings in the main feedwater lines (D1.1.1).	*Same as effect of General, Crevice, and Pitting, Corrosion on the piping and fittings in the main feedwater lines (D1.1.1).*	Yes, Element 4 should be further evaluated

NO

CHEMISTRY CONTROL PROGRAM (SECONDARY) VIII D1-3 CHAPTER (SEE # 11)

SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR CHEM. CONTROL PROGRAM (SECONDARY)

D2. Feedwater Systems (BWR)

D2.1 Main Feedwater Line

D2.1.1 Pipe and Fittings

D2.1.2 Bolting for Flange Connections

D2.2 Valves (Control, Check, and Hand Valves)

D2.2.1 Body

D2.3 Feedwater Pump (Steam Turbine- and Motor-Driven)

D2.3.1 Casing

D2.3.2 Suction and Discharge Lines

VIII STEAM AND POWER CONVERSION SYSTEMS

D2. FEEDWATER SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.1.1	Main Feedwater Line (Group B & D)	Piping and Fittings	Carbon Steel (CS)	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. NRC BI 87-01. NRC GL 89-08. NRC IN 91-28. NRC IN 92-35. NRC IN 93-21. NRC IN 95-11. EPRI NSAC-202L-R2. EPRI TR-103515.

VIII STEAM AND POWER CONVERSION SYSTEM
D2. Feedwater System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the main feedwater system for boiling water reactors (BWRs) extending from the condensate and condensate booster system to the outermost feedwater isolation valve on the feedwater lines to the reactor vessel, and consist of the main feedwater lines, feedwater pumps, and valves. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," portions of the feedwater system extending from the outermost containment isolation valves up to and including the shutoff valve or the first valve that is either normally closed or capable of closure during all modes of normal reactor operation are classified as Group B quality standards, and the remainder as Group D. Portion of the feedwater system extending from the reactor vessel up to the second isolation valve outside the containment is classified as Group A standards and is covered in Table IV C1. The aging management program for isolation valves in the feedwater system is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the feedwater system include the reactor coolant pressure boundary (Table IV C1), main steam system (Table VIII B2), extraction steam system (Table VIII C), and condensate system (Table VIII E).

VIII STEAM AND POWER CONVERSION SYSTEMS
D2. FEEDWATER SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D2.1.2	Main Feedwater Line (Group B)	Bolting for Flange Connections	High-strength Low-alloy Steel	Air, Leaking treated water	Attrition	Wear	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. ASME Section XI, 1989 Edition.

VIII STEAM AND POWER CONVERSION SYSTEMS
D2. FEEDWATER SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 and implemented through NRC Generic Letter 89-08; CHECWORKS Code: EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for water chemistry in BWRs (TR-103515).	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters, or selection of materials resistant to E/C.	No

VIII STEAM AND POWER CONVERSION SYSTEMS
D2. FEEDWATER SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
D2.2.1	Valves (Control, Check, and Hand Valves)	Body	Stainless Steel (SS), Carbon Steel (CS)	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D2.1.1).*
D2.3.1, D2.3.2	Feedwater Pump (Steam Turbine- and Motor-Driven)	Casing, Suction and Discharge Lines	Casing: SS, Suction & Discharge Lines: CS	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D2.1.1).*

VIII STEAM AND POWER CONVERSION SYSTEMS
D2. FEEDWATER SYSTEM (Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in single-phase systems have occurred in feedwater and condensate systems (NRC Bulletin No. 87-01, INs 81-28, 92-35, 95-11). The AMP outlined in NUREG-1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
Recommendations for a comprehensive bolting integrity program delineated in NUREG–1339 on resolution of Generic Safety Issue 29 and implemented through NRC Generic Letter 91-17; additional details on bolting integrity outlined in EPRI NP-5769. For valves classified as Group B Quality Standards inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Subsection IWC, Table IWC 2500-1, examination categories C-D for pressure retaining bolting and testing category C-H for system leakage.	***(1) Scope of Program:*** The staff guidance of NRC Generic Letter (GL) 91-17 provides assurances that plant specific comprehensive bolting integrity programs have been implemented to ensure bolting reliability. The NRC staff recommendations and guidelines for a comprehensive bolting integrity program is delineated in NUREG-1339, and the industry's technical basis for the program is outlined in EPRI NP-5769. ***(2) Preventive Actions:*** Selection of bolting material and the use of lubricants and sealants in accordance with guidelines of EPRI NP-5769 and additional requirements of NUREG 1339, prevent or mitigate degradation and failure of all safety-related closure bolting. ***(3) Parameter Monitored/ Inspected:*** The AMP monitors the effects of aging degradation on the intended function of closure bolting by detection of leakage, and by detection and sizing of cracks by inservice inspection (ISI). Inspection requirements of ASME Section XI, Table IWC 2500-1, examination category C-D for pressure retaining bolting greater than 2 in. in diameter specify volumetric examination of the entire length of bolts. However, because most failures have occurred in fasteners 2 in. or smaller, based on IE Bulletin 82-02, enhanced inspection and improved techniques are recommended. These examinations may be conducted on one component among a group of components with similar design and performing similar functions in the system. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, and additional requirements of EPRI NP-5769. Requirements of Table IWC 2500-1 category C-H specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 components. ***(4) Detection of Aging Effects:*** Degradation of the closure bolting can not occur without crack initiation. Also, loss of prestress or attrition of the closure bolting would result in leakage. The extent and schedule of inspection assure detection of aging degradation before the loss of intended function of closure bolting. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI are effective and adequate for timely detection of cracks and leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test is conducted at or	No

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any cracks in closure bolting are evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3513. ***(7) Corrective Actions:*** Repair and replacement is in accordance with guidelines of EPRI NP-5769. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** The bolting integrity programs developed and implemented in accordance with commitments made in response to NRC communications on bolting events have provided effective means of ensuring bolting reliability.	
Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D2.1.1).	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D2.1.1).*	No
Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D2.1.1).	*Same as effect of erosion/corrosion on the piping and fittings in the main feedwater lines (D2.1.1).*	No

E. Condensate System

E.1 Condensate Lines

E.1.1 Piping and Fittings

E.2 Valves

E.2.1 Body

E.3 Condensate Pumps (Main and Booster Pumps)

E.3.1 Casing

E.4 Condensate Coolers/Condensers

E.4.1 Tubes

E.4.2 Tubesheet

E.4.3 Channel Head

E.4.4 Shell

E.5 Condensate Storage

E.5.1 Tank

E.6 Condensate Cleanup System

E.6.1 Piping and Fittings

E.6.2 Demineralizer

E.6.3 Strainer

E.6.4 Filter

VIII STEAM AND POWER CONVERSION SYSTEM
E. Condensate System

System, Structures, and Components

The system, structures, and components included in this table comprise the condensate system for both pressurized water reactors (PWRs) and boiling water reactors (BWRs) extending from the condenser hotwells to the suction of feedwater pumps, including condensate and condensate booster pumps, condensate coolers, condensate cleanup system, and condensate storage tanks. All components in the condensate system are classified as Group D Quality Standards.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the condensate system include the steam turbine system (Table VIII A), main steam system (Tables VIII B1 and B2), feedwater system (Tables VIII D1 and D2), auxiliary feedwater system (Table VIII G, PWR only), reactor water cleanup system (Table VII E3, BWR and PWR if used), and condensate storage facility (Table VII E4).

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E.1.1	Condensate Lines	Piping and Fittings	Carbon Steel (CS)	Treated water (BWRs: reactor coolant; PWRs: secondary side water)	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. NRC BI 87-01. NRC GL 89-08. NRC IN 91-28. NRC IN 92-35. NRC IN 93-21. NRC IN 95-11. EPRI NSAC-202L-R2. EPRI TR-10315. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E.2.1	Valves	Body	Stainless Steel (SS), Carbon Steel (CS)	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	*Same as effect of erosion/corrosion on the piping and fittings in the condensate lines (E.1.1).*
E.3.1	Condensate Pumps (Main and Booster Pumps)	Casing	CS	Treated water	Wall Thinning	Erosion/ Corrosion (E/C)	*Same as effect of erosion/corrosion on the piping and fittings in the condensate lines (E.1.1).*
E.4.1 thru E.4.4	Miscellaneous Coolers/ Condensers (Serviced by Closed Cycle Cooling Water)	Tubes, Tubesheet, Channel Head, Shell	Tubes: SS, Tubesheet: CS, Channel Head: CS, Shell: CS	Treated Water (BWRs: reactor coolant; PWRs secondary side water) on one side; Closed Cycle Cooling Water (Treated Water) on the other side	Loss of Material	General, Crevice, and Pitting Corrosion	ASTM D95-83. ASME OM S/G, Pt 2. NRC GL 89-13. Plant Technical Specifications. EPRI TR-10315. EPRI TR-102134 Rev. 3.

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VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for water chemistry in BWRs (TR-103515) and secondary water in PWRs (TR-102134, Rev. 3).	[illegible] Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurance that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two-phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. [illegible] by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. [illegible] service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters or selection of materials resistant to E/C.	No

REVISED FLOW ACCELERATED CORROSION PROGRAM (PROVIDED AS INSERT #10) (SEE CHAPTER #11) VIIIE-1

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR FLOW ACCELERATED CORROSION PROGRAM.

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E.4.1 thru E.4.4	Miscellaneous Coolers/ Condensers (Serviced by Open Cycle Cooling Water)	Tubes, Tubesheet, Channel Head, Shell	Tubes: SS, Tubesheet: CS, Channel Head: CS, Shell: CS	Treated Water on one side; Open Cycle Cooling Water (Raw Water) on the other side	Loss of Material	General and Microbiologically influenced Corrosion	NRC GL 89-13. ASTM D95-83. NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96. NRC IN 94-03. Plant Technical Specifications. EPRI TR-10315. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in single-phase systems have occurred in feedwater and condensate systems (NRC Bulletin No. 87-01, INs 81-28, 92-35, 95-11). The AMP outlined in NUREG-1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
Same as effect of erosion/corrosion on the piping and fittings in the condensate lines (E.1.1).	*Same as effect of erosion/corrosion on the piping and fittings in the condensate lines (E.1.1).*	No
Same as effect of erosion/corrosion on the piping and fittings in the condensate lines (E.1.1).	*Same as effect of erosion/corrosion on the piping and fittings in the condensate lines (E.1.1).*	No
The program relies on preventive measures to mitigate corrosion by monitoring and control of water chemistry and cooling water chemistry to minimize exposure to aggressive environments, and performance testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably.	(1) Scope of Program: The program includes [illegible] and control of water chemistry and cooling water chemistry to minimize exposure to aggressive environments, and performance testing in accordance with ASME OM-Standards and Guides, Part 2 provides assurance that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably. ***(2) Preventive Actions:*** Use of appropriate materials, lining or coating to protect the underlying metal surfaces, and control of secondary side water chemistry and cooling water chemistry to minimize exposure to aggressive environment. (3) Parameters Monitored/Inspected: The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and in-service testing to evaluate component performance. Performance testing is conducted in accordance with ASME OM 6/G, Part 2. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. (5) Monitoring and Trending: Results from performance tests to verify the heat transfer capabilities are trended. Also, based on the recommendations of NRC GL 89-13 or its equivalent, if adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to include inspection and maintenance program for closed-cycle cooling water system to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety-	No

SECONDARY WATER CHEMISTRY PROGRAM (INSERT #14 SEE CHAPTER 11 #11) VIII E-3

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE SECONDARY WATER CHEMISTRY PROGRAM

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E.4.1 thru E.4.4	Miscellaneous Coolers/ Condensers (Serviced by Open Cycle Cooling Water)	Tubes, Tubesheet, Channel Head, Shell	Tubes: SS, Tubesheet: CS, Channel Head: CS, Shell: CS	Treated Water on one side; Open Cycle Cooling Water (Raw Water) on the other side	Buildup of Deposit	Biofouling	*Same as effect of general and microbiologically influenced corrosion on miscellaneous coolers tubes (E.4.1), tubesheet (E.4.2), channel head (E.4.3), and shell (E.4.4).*
E.5.1	Condensate Storage	Tank	CS, SS	<90°C Treated water	Loss of Material	General, Crevice, and Pitting Corrosion	EPRI TR-10315. EPRI TR-102134 Rev. 3.

SEE VIII E-4 (SEPARATE LINE ITEM)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) related systems serviced by closed-cycle cooling water. ***(6) Acceptance Criteria:*** Heat exchanger performance test results are evaluated in accordance with the guidelines of ASME OM S/G Part 2. Maximum levels for various impurities in secondary side water and cooling water are specified. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken in accordance with OM S/G Part 2. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval procedures, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related degradation has been reported for the miscellaneous coolers serviced by closed cycle cooling water system.	
The program relies on preventive measures to mitigate corrosion by monitoring and control of water chemistry to minimize exposure to aggressive environments, and implementation of the recommendations of Generic Letter 89-13 or an equally effective program to ensure that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements.	***(1) Scope of Program:*** The program includes monitoring and control of water chemistry to minimize exposure to aggressive environments, and staff recommendations of Generic Letter (GL) 89-13 or an equivalent program provide assurance that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Guidelines of GL 89-13 include (a) surveillance and control of biofouling, (b) test program to verify heat transfer capabilities, (c) routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling, will not degrade the performance of safety-related systems serviced by open-cycle cooling water, (d) system walkdown inspection to ensure compliance with licensing basis, and (e) review of maintenance, operating, and training practices and procedures. ***(2) Preventive Actions:*** The component is constructed of appropriate materials, control of secondary side water chemistry, and lining or coating protect the underlying metal surfaces from being exposed to aggressive cooling water environment. Based on GL 89-13 cooling water system is continuously chlorinated or treated with biocide whenever the potential for biological fouling species exists. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. Based on recommendations of GL 89-13 or its equivalent, cooling water system is inspected for biofouling organisms, sediment, protective coating failure, and corrosion; and cooling water flow and temperature are monitored for component performance evaluation to ensure that flow blockage or excessive fouling accumulation does not exist. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify heat transfer capabilities are	No

SECONDARY WATER CHEMISTRY PROGRAM (INSERT #14 (SEE CHAPTER # 11 VIII E-3

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE REVISED WATER CHEMISTRY PROGRAM.

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E.6.1 thru E.6.4	Condensate Cleanup System	Piping and Fittings, Demineralizer, Strainer, Filter	CS	Treated Water	Loss of Material	General, Crevice, and Pitting Corrosion	EPRI TR-10315. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) trended. ***(6) Acceptance Criteria:*** Any relevant conditions related to corrosion or leakage are compared to established acceptable limits. Maximum levels for various impurities in secondary side water and cooling water are specified. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken. Root cause evaluation is performed when acceptable limits are exceeded or leakage is detected. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Significant microbiologically influenced corrosion [NRC Information Notice (IN) 85-30], failure of protective coatings (IN 85-24), and fouling (IN 81-21, 86-96) has been observed in a number of heat exchangers. Although the AMP provides an effective means to manage the effects of corrosion on the intended function of heat exchangers, results of service water system operational performance inspections (IN 94-03) indicate that deficiencies still exist in implementation of GL 89-13.	
Same as effect of general and microbiologically influenced corrosion on miscellaneous coolers tubes (E.4.1), tubesheet (E.4.2), channel head (E.4.3), and shell (E.4.4).	*Same as effect of general and microbiologically influenced corrosion on miscellaneous coolers tubes (E.4.1), tubesheet (E.4.2), channel head (E.4.3), and shell (E.4.4).*	No
The program includes water chemistry program based on EPRI guidelines for water chemistry in BWRs (TR-103515) and secondary water in PWRs (TR-102134 Rev. 3).	***(1) Scope of Program:*** The program relies on monitoring and control of water chemistry based on EPRI guidelines for water chemistry in BWRs (TR-103515) and secondary water chemistry in PWRs (TR-102134 Rev. 3) for managing the effects of loss of material due to general, crevice, or pitting corrosion. ***(2) Preventive Actions:*** The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions for control of water chemistry. Stringent control of system water chemistry by frequent monitoring and timely corrective action when specified impurity levels are exceeded prevent or mitigate corrosion. ***(3) Parameters Monitored/ Inspected:*** The parameters monitored are the water pH and concentration of corrosive impurities (chlorides, sulfates, dissolved oxygen, sodium, silica). ***(4) Detection of Aging Effects:*** An one-time inspection of a representative sample of the system population and most susceptible locations in the system should be conducted to verify effectiveness of the chemistry control program and to ensure that significant degradation is not occurring or that it would not affect the CLB and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant	Yes, Element 4 should be further evaluated

VIII STEAM AND POWER CONVERSION SYSTEMS
E. CONDENSATE SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) technical specification. Inspection should be performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, or any other formal program approved by the NRC. ***(5) Monitoring and Trending:*** The frequency of sampling water chemistry varies from continuous, daily, weekly, or as required based on plant operating conditions. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions. ***(6) Acceptance Criteria:*** Maximum levels for various impurities are specified. Any evidence of the presence of an aging effect or unacceptable results is evaluated. ***(7) Corrective Actions:*** When measured water chemistry parameters are outside the specified range, corrective actions are taken which vary from simple manipulations to bring the parameter back within the specified value to unit shut down in more extreme cases. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No corrosion related degradation has resulted in loss of component intended functions on systems for which water chemistry is controlled.	
Same as for General, Crevice, and Pitting Corrosion of Item E.5.1 condensate storage tank.	*Same as for General, Crevice, and Pitting Corrosion of Item E.5.1 condensate storage tank.*	Yes, Element 4 should be further evaluated

F. Steam Generator Blowdown System (PWR)

F.1 Blowdown Lines

F.1.1 Pipe and Fittings (Group B)

F.1.2 Pipe and Fittings (Group D)

F.2 Valves

F.2.1 Body

F.3 Blowdown Pump

F.3.1 Casing

F.4 Blowdown Heat Exchanger

F.4.1 Tubes

F.4.2 Tubesheet

F.4.3 Channel Head

F.4.4 Shell

VIII STEAM AND POWER CONVERSION SYSTEM

F. Steam Generator Blow-down System (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the steam generator blow-down system for pressurized water reactors (PWRs) extending from the steam generator through the blow-down condenser. The portion of the blow-down system extending from the steam generator up to the isolation valve outside the containment is classified as Group B and the remainder as Group D Quality Standards. The aging management program for isolation valves in the blow-down system is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the blow-down system include the steam generator (Tables IV D1 and D2) and open or closed cycle cooling water systems (Table VII C1 or C2).

VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F.1.1, F.1.2	Blowdown Lines	Piping and Fittings (Group B), Piping and Fittings (Group D)	Carbon Steel (CS)	Secondary Side Treated Water	Wall Thinning	Erosion/ Corrosion (E/C)	NUREG-1344. NRC BI 87-01. NRC GL 89-08. NRC IN 91-28. NRC IN 93-21. NRC IN 95-11. NRC IN 97-84. EPRI NSAC-202L-R2. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for secondary water chemistry in PWRs (TR-102134, Rev. 3).	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition, analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outages. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters or selection of materials resistant to E/C.	No

FLOW ACCELERATED CORROSION PROGRAM (INSERT VIII F-1) (SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE FLOW ACCELERATED CORROSION PROGRAM.

VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F.1.1, F.1.2	Blowdown Lines	Piping and Fittings (Group B), Piping and Fittings (Group D)	Carbon Steel (CS)	Secondary Side Treated Water	Loss of Material	General, Crevice, and Pitting Corrosion	EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS
F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in single-phase systems have occurred in feedwater and condensate [illegible] Bulletin No. 87-01, INs 91-28, 95-11); [illegible] problems in two-phase piping have occurred in extraction steam lines (INs 89-53, 97-84) and moisture separation reheater and feedwater heater drains (INs 89-53, 91-18, 93-21, 97-84). The AMP outlined in NUREG-1344 and EPRI report and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
The program relies on preventive measures to mitigate corrosion by monitoring and control of water chemistry in accordance with the EPRI guidelines of TR-102134, Rev. 3.	***(3) Scope of Program:*** The program [illegible] and control of water chemistry (EPRI TR 102134 Rev. 3) for managing the effects of loss of material due to general, crevice, or pitting corrosion. ***(2) Preventive Actions:*** Stringent control of system water chemistry by frequent monitoring and timely corrective action when specified impurity levels are exceeded prevent or mitigate corrosion. The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions for control of secondary and [illegible] ***(3) Parameters Monitored/Inspected:*** The parameters monitored are the water pH and concentration of corrosive impurities (chlorides, sulfates, dissolved oxygen, sodium, silica). ***(4) Detection of Aging Effects:*** An one-time inspection of representative samples of the system population and most susceptible locations in the system should be conducted to verify effectiveness of the chemistry control program and to ensure that significant degradation is not occurring or that it would not affect the [illegible] and the component intended functions will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specifications. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, or any other formal program approved by the NRC. ***(5) Monitoring and Trending:*** The frequency of sampling water chemistry varies from continuous, daily, weekly, or as required based on plant	Yes, Element 4 should be further evaluated

SECONDARY WATER CHEMIST PROGRAM (INSERT #14 VIII F-2)

(SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE SECONDARY WATER CHEMISTRY PROGRAM

VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F.2.1	Valves	Body	CS	Secondary Side Treated Water	Wall Thinning	Erosion/ Corrosion	*Same as effect of erosion/corrosion on the piping and fittings in the blowdown lines (F.1.1 and F.1.2).*
F.2.1	Valves	Body	CS	Secondary Side Treated Water	Loss of Material	General, Crevice, and Pitting Corrosion	EPRI TR-102134 Rev. 3.
F.3.1	Blowdown Pump	Casing	CS	Secondary Side Treated Water	Wall Thinning	Erosion/ Corrosion	*Same as effect of erosion/corrosion on the piping and fittings in the blowdown lines (F.1.1 and F.1.2).*
F.3.1	Blowdown Pump	Casing	CS	Secondary Side Treated Water	Loss of Material	General, Crevice, and Pitting Corrosion	EPRI TR-102134 Rev. 3.
F.4.1 thru F.4.4	Blowdown Heat Exchanger (Serviced by Closed Cycle Cooling Water)	Tubes, Tubesheet, Channel Head, Shell	Tubes: SS; Tubesheet: CS; Channel Head: CS; Shell: CS	Secondary Side Treated Water on one side; Closed Cycle Cooling Water (Treated Water) on the other side	Loss of Material	General, Crevice, and Pitting Corrosion	ASTM D95-83. ASME OM-S/G, Pt 2. NRC GL 89-13.

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VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) operating conditions. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions. ***(6) Acceptance Criteria:*** Maximum levels for various impurities are specified. Any evidence of the presence of an aging effect or unacceptable results is evaluated. ***(7) Corrective Actions:*** When measured water chemistry parameters are outside the specified range, corrective actions are taken which vary from simple manipulations to bring the parameter back within the specified value to unit shut down in more extreme cases. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related problem has been reported for piping and fittings in steam generator blowdown system.	
Same as effect of erosion/corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).	*Same as effect of erosion/corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).*	No
Same as effect of general, crevice, and pitting corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).	*Same as effect of general, crevice, and pitting corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).*	Yes, Element 4 should be further evaluated
~~*Same as effect of erosion/corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).*~~	~~*Same as effect of erosion/corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).*~~	~~No~~
~~*Same as effect of general, crevice, and pitting corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).*~~	~~*Same as effect of general, crevice, and pitting corrosion on the piping and fittings in the blowdown lines (F.1.1and F.1.2).*~~	~~Yes, Element 4 should be further evaluated~~
~~The program relies on preventive~~ measures to mitigate corrosion by monitoring and control of secondary ~~side water chemistry and cooling water~~ chemistry to minimize exposure to aggressive environments, ~~and performance testing in accordance with ASME OM Standards and Guides, Part 2~~ to ensure that the heat exchanger ~~serviced by the closed-cycle cooling~~ water system is performing its function acceptably .	~~***(1) Scope of Program:*** The program includes monitoring~~ and control of secondary side water chemistry and cooling water chemistry to minimize exposure to aggressive ~~environments, and performance testing in accordance~~ with ASME OM-Standards and Guides, Part 2 provides ~~assurance that the heat exchanger serviced by the closed-~~cycle cooling water system is performing its function acceptably. ~~***(2) Preventive Actions:***~~ Use of appropriate materials, lining or coating to protect the underlying metal surfaces, and control of secondary side water chemistry and cooling water chemistry to minimize ~~exposure to aggressive environment. ***(3) Parameters Monitored/Inspected:***~~ The AMP monitors the effects of corrosion by surveillance program to detect coolant	~~No~~

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VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F.4.1 thru F.4.3	Blowdown Heat Exchanger (Serviced by Open Cycle Cooling Water)	Tubes, Tubesheet, Channel Head	Tubes: SS, Tubesheet: CS, Channel Head: CS	Secondary Side Treated Water on one side; Open Cycle Cooling Water (Raw Water) on the other	Loss of Material	General and Microbiologically Influenced Corrosion	NRC GL 89-13. ASTM D95-83. NRC IN 91-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96. NRC IN 94-03.

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VIII STEAM AND POWER CONVERSION SYSTEMS
F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) leakage and inservice testing to evaluate component performance. Performance testing is conducted in accordance with ASME OM S/G, Part 2. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify the heat transfer capabilities are trended. Also, based on the recommendations of NRC GL 89-13 or its equivalent, if adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to include inspection and maintenance program for closed-cycle cooling water system to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety-related systems serviced by closed cycle cooling water. ***(6) Acceptance Criteria:*** Heat exchanger performance test results are evaluated in accordance with the guidelines of ASME OM S/G Part 2. Maximum levels for various impurities in secondary side water and cooling water are specified. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken in accordance with OM S/G Part 2. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related degradation has been reported for the blowdown heat exchangers serviced by closed cycle cooling water system.	
The program relies on preventive measures to mitigate corrosion by monitoring and control of secondary side water chemistry to minimize exposure to aggressive environments, and implementation of the guidelines of GL 89-13 or an equally effective program to ensure that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements.	***(1) Scope of Program:*** The program includes monitoring and control of secondary side water chemistry to minimize exposure to aggressive environments, and staff recommendations of Generic Letter (GL) 89-13 or an equivalent program provide assurance that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Guidelines of GL 89-13 include (a) surveillance and control of biofouling, (b) test program to verify heat transfer capabilities, (c) routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling, can not degrade the performance of safety-related systems serviced by open-cycle cooling water, (d) system walkdown inspection to ensure compliance with licensing basis, and (e) review of maintenance, operating, and training practices and procedures. ***(2) Preventive Actions:*** The component is constructed of appropriate materials, control of secondary side water chemistry and lining or coating protect the underlying metal surfaces from being exposed to aggressive cooling water environment. Based on GL 89-13 cooling water system is continuously chlorinated or treated with biocide whenever the potential for biological	No

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VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F.4.1 thru F.4.3	Blowdown Heat Exchanger (Serviced by Open Cycle Cooling Water)	Tubes; Tubesheet; Channel Head	Tubes: SS; Tubesheet: SS; Channel Head: SS	Secondary Side Treated Water on one side; Open Cycle Cooling Water (Raw Water) on the other side	Buildup of Deposit	Biofouling	NRC GL 89-13. ASTM D99-88. NRC IN 81-21. NRC IN 83-24. NRC IN 85-30. NRC IN 86-96. NRC IN 94-03.

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VIII STEAM AND POWER CONVERSION SYSTEMS

F. STEAM GENERATOR BLOWDOWN SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) fouling species exists. **(3) Parameters Monitored/ Inspected:** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. Based on recommendations of GL 89-13 or its equivalent, cooling water system is inspected for biofouling organisms, sediment, protective coating failure, and corrosion; and cooling water flow and temperature are monitored for component performance evaluation to ensure that flow blockage or excessive fouling accumulation does not exist. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Results from performance tests to verify heat transfer capabilities are trended. ***(6) Acceptance Criteria:*** Any relevant conditions related to corrosion or leakage are compared to established acceptable limits. Maximum levels for various impurities in secondary side water and cooling water are specified. ***(7) Corrective Actions:*** If the heat exchanger fails to perform adequately, corrective actions are taken. Root cause evaluation is performed when acceptable limits are exceeded or leakage is detected. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Significant microbiologically influenced corrosion [NRC Information Notice (IN) 85-30], failure of protective coatings (IN 85-24), and fouling (IN 81-21, 86-96) has been observed in a number of heat exchangers. Although the AMP provides an effective means to manage the effects of corrosion on the intended function of blowdown heat exchanger, results of service water system operational performance inspections (IN 94-03) indicate that deficiencies still exist in implementation of GL 89-13.	VIII F-3
Same as effect of general and microbiologically influenced corrosion on blowdown heat exchanger tubes (F.4.1), tubesheet (F.4.2), and channel head (F.4.3).	*Same as effect of general and microbiologically influenced corrosion on blowdown heat exchanger tubes (F.4.1), tubesheet (F.4.2), and channel head (F.4.3).*	No

G. Auxiliary Feedwater (AFW) System (PWR)

G.1 Auxiliary Feedwater Piping

G.1.1 Pipe and Fittings (Above Ground)

G.1.2 Pipe and Fittings (Buried)

G.2 AFW Pumps (Steam Turbine- and Motor-Driven)

G.2.1 Casing

G.2.2 Suction and Discharge Lines

G.2.3 Bolting

G.3 Valves (Control, Check, Hand Valves)

G.3.1 Body

G.4 Condensate Storage (Emergency)

G.4.1 Tank

G.5 Bearing Oil Coolers

G.5.1 Shell

G.5.2 Tubes

G.5.3 Tubesheet

VIII STEAM AND POWER CONVERSION SYSTEM

G. Auxiliary Feedwater System (Pressurized Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the auxiliary feedwater (AFW) system for pressurized water reactors (PWRs) extending from the condensate storage system to the outermost containment isolation valve on the auxiliary feedwater lines to the steam generator, and consist of auxiliary feedwater piping, auxiliary feedwater pumps, valves, and pump turbine oil coolers. Based on US Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam, and Radioactive-Waste-Containing Components of Nuclear Power Plants," portions of the auxiliary feedwater system that are required for their safety functions and that either do not operate during any mode of normal reactor operation or cannot be tested adequately, should be classified as Group B quality standards, and the remainder classified as Group C. Portion of the auxiliary feedwater system extending from the secondary side of the steam generator up to the second isolation valve outside the containment is classified as Group B standard, and is covered in Tables IV D1 and D2. The aging management program for isolation valves in the auxiliary feedwater system is reviewed in Table V C.

The pumps and valves internals are considered to be active components. They perform their intended functions with moving parts or with a change in configuration and are not subject to aging management review pursuant to 10 CFR 54.21(a)(1)(i).

System Interfaces

The systems that interface with the auxiliary feedwater system include the steam generator (Tables IV D1 and D2), main steam system (Table VIII B1), and condensate system (Table VIII E).

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VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.1.1	Auxiliary Feedwater (AFW) Piping	Piping and Fittings (Above Ground)	Carbon Steel (CS)	<90°C Treated water	Wall Thinning	Erosion/ ~~Corrosion (E/C)~~	NUREG-1344. NRC BI 87-01. NRC GL 89-08. NRC IN 86-106. NRC IN 91-19. NRC IN 91-28. NRC IN 92-35. NRC IN 93-21. NRC IN 95-11. EPRI NSAC-202L-R2. EPRI TR-102134 Rev. 3.

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program delineated in NUREG-1344 and implemented through NRC Generic Letter 89-08; CHECWORKS Code; EPRI guidelines of NSAC-202L-R2 for effective erosion/corrosion program; and water chemistry program based on EPRI guidelines for secondary water chemistry (TR-102134 Rev. 3).	***(1) Scope of Program:*** The NUMARC program delineated in Appendix A of NUREG-1344 and implemented through NRC Generic Letter (GL) 89-08 provides assurances that procedures or administrative controls are in place to assure that the NUMARC program or other equally effective programs are implemented and the structural integrity of all high-energy (two phase as well as single phase) carbon steel systems is maintained. The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer term corrective actions. ***(2) Preventive Actions:*** The rate of E/C is affected by piping material, geometry and hydrodynamic conditions, and operating conditions such as temperature, pH, and dissolved oxygen content. Mitigation is by selecting material considered resistant to E/C, adjusting water chemistry and operating conditions, and improving hydrodynamic conditions through design modifications. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of E/C on the intended function of piping by measuring wall thickness by nondestructive examination and performing analytical evaluations. The inspection program delineated in NUREG-1344 requires ultrasonic and radiographic testing of 10 most susceptible locations and 5 additional locations based on unique operating conditions or special considerations. For each location outside the acceptance guidelines, the inspection sample is expanded based on engineering judgment. In addition analytical models are used to predict E/C in piping systems based on specific plant data including material and hydrodynamic and operating conditions. The CHECWORKS Code is used for predicting wall thinning. ***(4) Detection of Aging Effects:*** Aging degradation of piping and fittings occurs by wall thinning; extent and schedule of inspection assure detection of wall thinning before the loss of intended function of the piping. ***(5) Monitoring and Trending:*** Inspection schedule of NUREG-1344 and EPRI guidelines should provide for timely detection of leakage. Inspections and analytical evaluations are performed during plant outage. If analysis shows unacceptable conditions, inspection of initial sample is performed within 6 months. ***(6) Acceptance Criteria:*** Based on the requirements of NUREG-1344 and additional guidelines of EPRI and of NRC Information Notice (IN) 93-21, inspection results are used to calculate number of refueling or operating cycles remaining before the component reaches Code minimum allowable wall thickness. If calculations indicate that an area will reach Code minimum (plus 10% margin), the component must be repaired or replaced. ***(7) Corrective Actions:*** Prior to service, repair or replace to meet the requirements of NUREG-1344 and additional guidance of EPRI and of NRC IN 93-21. Follow-up inspections are performed to confirm or quantify thinning and take longer term corrective actions such as adjust chemistry and operating parameters, or selection of materials resistant to E/C.	No

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.1.1, G.1.2	Auxiliary Feedwater Piping	Piping and Fittings (Above Ground), Piping and Fittings (Buried)	CS	<90°C Treated water	Loss of Material	General, Crevice, and Pitting Corrosion	EPRI TR-102134 Rev. 3.

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VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Wall-thinning problems in single-phase systems have occurred in feedwater and condensate systems (NRC Bulletin No. 87-01, INs 86-106 & supplements, 91-19, 91-28, 92-35, 95-11). For most AFW system, fluid flow, temperature, and pressure drop conditions are unlikely to cause cavitation erosion; it is limited to locations downstream of flow orifices. The AMP outlined in NUREG-1344 and implemented through GL 89-08 has provided effective means of ensuring the structural integrity of all high-energy carbon steel systems.	
~~The program relies on preventive measures to mitigate corrosion by monitoring and control of water chemistry in accordance with the EPRI guidelines of TR-102134, Rev. 3.~~	~~(1) Scope of Program:~~ The program relies on monitoring and control of water chemistry (EPRI TR 102134 Rev. 3) for managing the effects of loss of material due to general, crevice, or pitting corrosion. ***(2) Preventive Actions:*** Stringent control of system water chemistry by frequent monitoring and timely corrective action when specified impurity levels are exceeded prevent or mitigate corrosion. The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions for control of secondary and demineralized water chemistry. ***(3) Parameters Monitored/Inspected:*** The parameters monitored are the water pH and concentration of corrosive impurities (chlorides, sulfates, dissolved oxygen, sodium, silica). ~~(4) Detection of Aging Effects:~~ An one-time inspection of representative sample of the system population and most susceptible locations in the system should be conducted to verify effectiveness of the chemistry control program and to ensure that significant degradation is not occurring or that it would not affect the CLB and the component intended function will be maintained during the extended period. Follow up actions are based on the inspection results and plant technical specification. Inspection is performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques. Selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, or any other formal program approved by the NRC. ***(5) Monitoring and Trending:*** The frequency of sampling water chemistry varies from continuous, daily, weekly, or as required based on plant operating conditions. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions. ***(6) Acceptance Criteria:*** Maximum levels	Yes, Element 4 should be further evaluated

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SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE SECONDARY WATER CHEMISTRY PROGRAM.

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.1.2	Auxiliary Feedwater Piping	Piping and Fittings (Buried) (External Surface)	CS	Soil	Loss of Material	General Corrosion, Galvanic Corrosion and Microbio-logically-influenced Corrosion	-

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) for various impurities are specified. Any evidence of the presence of an aging effect or unacceptable results is evaluated. ***(7) Corrective Actions:*** When measured water chemistry parameters are outside the specified range, corrective actions are taken which vary from simple manipulations to bring the parameter back within the specified value to unit shut down in more extreme cases. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval [illegible] in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related problem has been reported for piping and fittings in AFW system.	
The program includes preventive measures to mitigate corrosion by protecting the external surfaces of the buried piping, per standard industry practice, ~~with external coating, wrapping, and a cathodic protection system, and surveillance.~~ INCLUDING SURVEILLANCE. VIII G-4	***(1) Scope of Program:*** The program relies on preventive measures, such as coating, wrapping, and cathodic protection, and surveillance for managing the effects of corrosion on the intended function of underground piping for auxiliary feedwater system. ***(2) Preventive Actions:*** Per industry practice, underground piping is coated with protective coating, such as tar or synthetic coating, and is wrapped with protective paper or plastic during installation for protecting piping from contacting with aggressive soil environment. A cathodic protection system may also be used to mitigate corrosion by counteracting galvanic activity. ***(3) Parameters Monitored/ Inspected:*** The effectiveness of the coatings and cathodic protection system, per standard industry practice, by measuring coating conductance, by pipe-to-soil potential surveys, by conducting bell hole examinations to visually examine the condition of the coating. ***(4) Detection of Aging Effects:*** An increase in coating conductance or the indication that certain portions of the pipe are not adequately protected indicate coating degradation. ***(5) Monitoring and Trending:*** The effects of corrosion are detectable by visual techniques and, based on operating experience, inspection of a sample of the buried pipe provides for timely detection of aging effects. Also, monitoring the coating conductance vs. time or current requirement vs. time provide indication of the condition of the coating and cathodic protection system. ***(6) Acceptance Criteria:*** In accordance with accepted industry practice, the assessment of the condition of the coating and cathodic protection system should be conducted on an annual basis. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Surveillance of AFW buried piping has shown no aging degradation.	No

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.2.1, G.2.2	AFW Pumps (Steam Turbine- and Motor-Driven)	Casing, Suction and Discharge Lines	CS	<90°C Treated Water	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Subsection ISTB. NRC GL 89-04. Plant Technical Specifications. EPRI TR-102134 Rev. 3.

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VIII **STEAM AND POWER CONVERSION SYSTEMS**

G. **Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)**

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The program includes preventive measures to mitigate corrosion by monitoring and control of water chemistry in accordance with the EPRI guidelines of TR-102134 Rev. 3 and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components or Table IWD 2500-1, test and examination category D-B for Class 3 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 and 3 pumps, and additional NRC staff guidelines of NRC Generic Letter 89-04, inservice testing performed in accordance with ASME Subsection IWP (or Operation and Maintenance Code Subsection ISTB) for pumps, or other approved program in the plant specifications.	[illegible] measures to mitigate crevice or pitting corrosion (EPRI TR 102134 Rev. 3) and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of the AFW system components. ***(2) Preventive Actions:*** Mitigation is by monitoring and control of secondary water chemistry and demineralized water chemistry to minimize concentration of corrosive impurities such as chlorides, sulfates, and oxygen. Chemical species and impurities are monitored either continuous, daily, weekly, or as required based on plant operating conditions. Corrective actions are taken when specified values are exceeded. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of corrosion by ISI to detect coolant leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all Class 2 components according to IWC-2500-1 category C-H, and Class 3 components according to IWD 2500-1 category D-B. Also, based on the requirements of 10 CFR 50.55a for Class 2 and 3 pumps and additional guidelines of NRC Generic Letter (GL) 89-04, IST is performed in accordance with ASME Subsection IWP (OM Code Subsection ISTB). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of ISI/IST assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** ISI/IST schedule of ASME Section XI should provide for timely detection of corrosion. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any relevant conditions detected during the leakage tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWB-3516 for Class 2 components, and IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in accordance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related problem has been reported for AFW pumps.	No

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SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR SECONDARY WATER CHEMISTRY PROGRAM.

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.2.1, G.2.3	AFW Pumps (Steam Turbine- and Motor-Driven)	Casing (external surface), Bolting	Casing: CS; Bolting: Low-alloy Steel; Nuts: CS	Air, Leaking Treated Water	Loss of Material	General Corrosion	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. ASME Section XI, 1989 Edition.

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Recommendations for a comprehensive bolting integrity program delineated in NUREG–1339 on resolution of Generic Safety Issue 29 and implemented through NRC Generic Letter 91-17; additional details on bolting integrity outlined in EPRI NP-5769. For components classified as Group B Quality Standards inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Subsection IWC, Table IWC 2500-1, examination categories C-D for pressure retaining bolting and testing category C-H for system leakage.	***(1) Scope of Program:*** The staff guidance of NRC Generic Letter (GL) 91-17 provides assurances that plant specific comprehensive bolting integrity programs have been implemented to ensure bolting reliability. The NRC staff recommendations and guidelines for a comprehensive bolting integrity program is delineated in NUREG-1339, and the industry's technical basis for the program is outlined in EPRI NP-5769. ***(2) Preventive Actions:*** Selection of bolting material and the use of lubricants and sealants in accordance with guidelines of EPRI NP-5769 and additional requirements of NUREG 1339, prevent or mitigate degradation and failure of all safety-related closure bolting. ***(3) Parameter Monitored/Inspected:*** The AMP monitors the effects of aging degradation on the intended function of closure bolting by detection of leakage, and by detection and sizing of cracks by inservice inspection (ISI). Requirements of ASME Section XI, Table IWC 2500-1, examination category C-D for pressure retaining bolting greater than 2 in. in diameter specify volumetric examination of the entire length of bolts. Because most failures have occurred in fasteners 2 in. or smaller, based on IEB 82-02, enhanced inspection and improved techniques are recommended. These examinations may be conducted on one valve among a group of valves with similar design and performing similar functions. Requirements for training and qualification of personnel and performance demonstration for procedures and equipment is in conformance with Appendices VII and VIII of ASME Section XI, and additional requirements of EPRI NP-5769. Requirements of Table IWC 2500-1 category C-H specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 valves. ***(4) Detection of Aging Effects:*** Degradation of the closure bolting occurs by crack initiation. Also, loss of prestress or attrition of the closure bolting would result in leakage. The extent and schedule of inspection assure detection of aging degradation before the loss of intended function of closure bolting. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI are effective and adequate for timely detection of cracks and leakage. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test is conducted at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any cracks in closure bolting are evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3513. ***(7) Corrective Actions:*** Repair and replacement is in accordance with guidelines and recommendations of EPRI NP-5769. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** The AMPs developed and implemented in accordance with commitments made in response to NRC communications on bolting events have provided effective means of ensuring bolting reliability.	No

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VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.3.1	Valves (Control, Check, and Hand Valves)	Body	CS	<90°C Treated Water	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. ASME OM Code-1990, Appendix I and Subsection ISTC. NRC GL 89-04. NRC GL 90-06. NRC GL 96-05. NRC IN 88-70. EPRI TR-102134 Rev. 3.

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VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The program includes preventive measures to mitigate crevice corrosion by control of water chemistry in accordance with the EPRI guidelines of TR-102134, Rev. 3 and, based on plant specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-H for pressure retaining Class 2 components or Table IWD 2500-1, test and examination category D-B for Class 3 components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 2 valves, and additional staff guidelines of NRC Generic Letter (GL) 88-04 regarding the scope of inservice testing (IST), NRC Information Notice (IN) 88-70 regarding scope and testing of safety-related check valves, and GL 96-05 regarding safety-related motor-operated valves, IST is performed in accordance with ASME Subsection IWV, to ensure that the changes in design-basis performance of safety-related valves resulting from degradation can be identified and managed. Furthermore, resolution of Generic Issue 70 delineated in NRC GL 90-06 requires power-operated relief valves and block valves be included within the scope of IST in accordance with ASME Subsection IWV.	***(1) Scope of Program:*** The program includes preventive measures to mitigate crevice or pitting corrosion (EPRI TR-102134 Rev. 3) and combination of inservice inspection (ISI) and inservice testing (IST) to monitor the effects of corrosion on the intended function of class 2 valves in the AFW system. ***(2) Preventive Actions:*** Mitigation is by monitoring and control of secondary water chemistry and demineralized water chemistry to minimize concentration of corrosive impurities such as chlorides, sulfates, and oxygen. Chemical species and impurities are monitored either continuous, daily, weekly, or as required based on plant operating conditions. Corrective actions are taken when specified impurity values are exceeded. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by ISI to detect leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 2 valves in accordance with Table IWC 2500-1 category C-H. Based on the requirements of 10 CFR 50.55a for ASME Code Class 2 valves and additional guidelines of NRC GLs 89-04 and 96-05, and IN 88-70, IST is performed in accordance with ASME Subsection IWV (OM Code Appendix I for safety and relief valves and Subsection ISTC for other valves). ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage through the boundary or component performance; extent and schedule of ISI/IST assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** ISI/IST schedule of ASME Section XI should provide for timely detection of corrosion. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection interval. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3100 and acceptance standards of IWC-3400 and IWC-3516 for Class 2 components. ***(7) Corrective Actions:*** Prior to service, corrective measures are needed to meet the requirements of IWB-3142 and IWA-5250. Repair and replacement are in conformance with IWA-4000 and IWB-4000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Inspections of check valve by NRC staff have revealed potential problems in the IST programs, e.g., many check valves in the AFW system were not included in the IST program and no review of how operability tests were being performed for check valves other than those used for containment isolation (IN 88-70).	No

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VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.4.1	Condensate Storage (Emergency)	Tank	SS	<90°C Treated Water	Loss of Material	~~General, Crevice, and Pitting Corrosion~~	ASME Section XI, 1989 Edition.
G.5.1 thru G.5.3	Bearing Oil Coolers (for Steam-Turbine Pump) (Serviced by Open Cycle Cooling Water)	Shell, Tubes, Tubesheet	Stainless Steel (SS), Carbon Steel (CS)	Oil on one side; Open Cycle Cooling Water (Raw Water) on the other side	Loss of Material	General and Microbio-logically influenced Corrosion	NRC GL 89-13. ASTM D95-83. NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96. NRC IN 94-03.

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for General, Crevice, and Pitting Corrosion of the internal surfaces of Items G.1.1 and G.1.2 above ground and buried AFW Piping and Fitting	*Same as for General, Crevice, and Pitting Corrosion of the internal surfaces of Items G.1.1 and G.1.2 above ground and buried AFW Piping and Fitting*	No
Surveillance program to monitor the pump turbine bearing oil system for water contamination and implementation of the recommendations of Generic Letter 89-13 or an equally effective program to ensure that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Mitigation is by the use of appropriate materials and lining/coating to protect the underlying metal surfaces from being exposed to aggressive environment.	***(1) Scope of Program:*** The program includes preventive measures to mitigate corrosion, surveillance program to monitor leakage to manage the effects of corrosion on the intended function of the pump turbine bearing oil system, and staff recommendations of Generic Letter (GL) 89-13 or an equivalent program provide assurance that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. Guidelines of GL 89-13 include (a) surveillance and control of biofouling, (b) test program to verify heat transfer capabilities, (c) routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling, can not degrade the performance of safety-related systems serviced by open-cycle cooling water, (d) system walkdown inspection to ensure compliance with licensing basis, and (e) review of maintenance, operating, and training practices and procedures. ***(2) Preventive Actions:*** The component is constructed of appropriate materials, and lining or coating prevent corrosion by protecting the underlying metal surfaces from being exposed to aggressive environment. Based on GL 89-13 cooling water system is continuously chlorinated or treated with biocide whenever the potential for biological fouling species exists. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. Water contamination in the turbine bearing oil coolers is monitored in accordance with the standard test methods of ASTM D95-83 and the results compared with acceptance criteria. Based on recommendations of GL 89-13 or its equivalent, cooling water system is inspected for biofouling organisms, sediment, protective coating failure, and corrosion; and cooling water flow and temperature are monitored for component performance evaluation to ensure that flow blockage or excessive fouling accumulation does not exist. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Oil samples from the turbine bearing oil system reservoirs are analyzed periodically, results of the analysis are monitored and trended. Results from performance tests to verify the heat transfer capabilities are trended. ***(6) Acceptance Criteria:*** Water contamination of oil should not exceed 0.1% by volume. ***(7) Corrective Actions:*** If water contamination levels exceed the acceptance criteria, the source of the water contamination is located and corrected. The contaminated oil is purified or replaced. If the heat exchanger fails to perform	No

SEE VIII G-9

VIII STEAM AND POWER CONVERSION SYSTEMS
G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.5.1 thru G.5.3	Bearing Oil Coolers (for Steam-Turbine Pump) (Serviced by Open Cycle Cooling Water)	Shell, Tubes, Tubesheet	Stainless Steel (SS), Carbon Steel (CS)	Oil on one side; Open Cycle Cooling Water (Raw Water) on the other side	Buildup of Deposit	Biofouling	NRC GL 89-13. ASTM D95-83. NRC IN 81-21. NRC IN 85-24. NRC IN 85-30. NRC IN 86-96. NRC IN 94-03.
G.5.1 thru G.5.3	Bearing Oil Coolers (for Steam-Turbine Pump) (Serviced by Closed Cycle Cooling Water)	Shell, Tubes, Tubesheet	Stainless Steel (SS), Carbon Steel (CS)	Oil on one side; Closed Cycle Cooling Water (Treated Water) on the other side	Loss of Material	General, Crevice, and Pitting corrosion	ASTM D95-83. ASME OM S/G, Pt 2. NRC GL 89-13.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) adequately, corrective actions are taken. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Significant microbiologically influenced corrosion [NRC Information Notice (IN) 85-30], failure of protective coatings (IN 85-24), and fouling (IN 81-21, 86-96) has been observed in a number of heat exchangers. Although the AMP provides an effective means to manage the effects of corrosion on the intended function of the bearing oil coolers, results of service water system operational performance inspections (IN 94-03) indicate that deficiencies and weaknesses still exist in implementation of GL 89-13.	
Same as effect of general and microbiologically influenced corrosion on bearing oil cooler shell (G.5.1), tubes G.5.2), and tubesheet (G.5.3).	*Same as effect of general and microbiologically influenced corrosion on bearing oil cooler shell (G.5.1), tubes G.5.2), and tubesheet (G.5.3.*	No
Surveillance program to monitor the pump turbine bearing oil system for water contamination and performance testing in accordance with ASME OM Standards and Guides, Part 2 to ensure that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably. Mitigation is by the use of appropriate materials and, based on specific plant design, by lining/coating to protect the underlying metal surfaces and control of cooling water chemistry to minimize exposure to aggressive environment.	***(1) Scope of Program:*** The program includes preventive measures to mitigate corrosion, surveillance program to monitor leakage to manage the effects of corrosion on the intended function of the pump turbine bearing oil system, and performance testing in accordance with ASME OM-S/G, Part 2 provide assurance that the heat exchanger serviced by the closed-cycle cooling water system is performing its function acceptably. ***(2) Preventive Actions:*** Use of appropriate materials, lining or coating to protect the underlying metal surfaces, and control of cooling water chemistry prevent or mitigate corrosion. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of corrosion by surveillance program to detect coolant leakage and inservice testing to evaluate component performance. Water contamination in the turbine bearing oil coolers is monitored in accordance with the standard test methods of ASTM D95-83 and the results compared with acceptance criteria. Performance testing is conducted in accordance with ASME OM S/G, Part 2. ***(4) Detection of Aging Effects:*** Degradation of component due to corrosion would result in leakage of coolant or degradation of component performance; extent and schedule of inspection/testing assure detection of corrosion before the loss of intended function of the component. ***(5) Monitoring and Trending:*** Oil samples from the turbine bearing oil system reservoirs are analyzed periodically, results of the analysis are monitored and trended. Results from performance tests to verify the heat transfer capabilities are trended. Also, based on the recommendations of NRC GL 89-13 or its equivalent, if adequacy of cooling water chemistry control can not be confirmed, implement Action III of GL 89-13 to	No

VIII STEAM AND POWER CONVERSION SYSTEMS

G. Auxiliary Feedwater (AFW) SYSTEM (Pressurized Water Reactor)

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) include inspection and maintenance program for closed-cycle cooling water system to ensure that corrosion, erosion, and protective coating failure can not degrade the performance of safety-related systems serviced by closed-cycle cooling water. ***(6) Acceptance Criteria:*** Water contamination of oil should not exceed 0.1% by volume. ***(7) Corrective Actions:*** If water contamination levels exceed the acceptance criteria, the source of the water contamination is located and corrected. The contaminated oil is purified or replaced. If the heat exchanger fails to perform adequately, corrective actions are taken. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with requirements of Appendix B to 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** No significant corrosion related degradation has been reported for the bearing oil coolers serviced by closed cycle cooling water system.	

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