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NUCLEAR ENERGY INSTITUTE

Douglas J. Walters
SR. PROJECT MANAGER, LICENSING
NUCLEAR GENERATION

June 1, 2000

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 Chapter VII of the Generic Aging Lessons Learned (GALL) Report. Two documents are provided for each section of the chapter. One document is a pen-and-ink 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.

As we mentioned in our previous cover letter, we continue to wrestle with the format incompatibility between that provided by your contractor and our software programs. For this reason, we are unable to provide the clean copy we had intended, but continue to explore alternatives to the formatting issue in hopes of providing clean copies in the near future.

We look forward to discussing the enclosed comments with the NRC staff. If you have any questions please call Bob Evans (202.739-8101), or me (202.739-8093).

Sincerely,

Douglas J. Walters

Douglas J. Walters

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

Enclosure

D042

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

A3.1 Piping

A3.1.1 Pipe, Fittings and Flanges

A3.1.2 Studs and Nuts

A3.2 Filter

A3.2.1 Studs and Nuts

A3.3 Strainer

A3.3.1 Studs and Nuts

A3.4 Check Valve

A3.4.1 Body and Bonnet

A3.4.2 Studs and Nuts

A3.5 Hand Valve

A3.5.1 Body and Bonnet

A3.5.2 Studs and Nuts

A3.5.3 Linings

A3.6 Heat Exchanger

A3.6.1 Shell

A3.6.2 Nozzles

A3.6.3 Studs and Nuts

A3.7 Ion Exchanger

A3.7.1 Studs and Nuts

A3.8 Pump

A3.8.1 Casing

A3.8.2 Studs and Nuts

A3.9 Flow Orifice

A3.9.1 Studs and Nuts

A3.10 Spent Fuel Transfer Tube

A3.10.1 Studs and Nuts

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

System, Structures, and Components

The system, structures, and components included in this table comprise the pressurized water reactor (PWR) spent fuel storage. The PWR spent fuel storage contains stainless steel spent fuel storage racks and Boraflex sheets (if used) submerged in a chemically treated borated water. The intended function of the spent fuel rack is to separate spent fuel assemblies. Boraflex sheets fastened to the storage cells provide for neutron absorption and help maintain subcriticality of spent fuel assemblies in the spent fuel pool. Based on 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 spent fuel storage are classified as Group C Quality Standards.

System Interfaces

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

A3-1
THIS DESCRIPTION IS FOR
SPENT FUEL STORAGE
NEED NEW DESCRIPTION

VII AUXILIARY SYSTEMS

A3. SPENT FUEL POOL COOLING AND CLEANUP (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A3.1.1	Piping	Pipe, Fittings, and Flanges	Stainless Steel (SS)	Chemically Treated Borated Water	Local Loss of Material	Pitting and Crevice Corrosion	~~ASME Section XI, 1989 Edition.~~ NRC IN 84-18. NRC IN 96-11. NRC GL 88-05 EPRI TR-105714. Plant Technical Specifications.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on minimizing impurities by monitoring and maintaining the borated water chemistry in accordance with the guidelines of EPRI TR-105714 and implemented by plant technical specifications, and inservice inspection (ISI) is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C for systems in support of residual heat removal from spent fuel storage pool.	~~*(1) Scope of Program:* The AMP relies on monitoring and~~ maintaining the water chemistry and inservice inspection (ISI) for managing the effects of pitting and crevice corrosion on the intended function of the spent fuel pool cooling and cleanup system components. ***(2) Preventive Actions:*** Monitoring and maintaining the system water chemistry in accordance with the guidelines of EPRI TR-105714 helps to minimize impurities in the system fluid. The AMP generally contains chemical parameter specifications, sampling frequency, analysis, and corrective actions. Chemical parameters, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled. The preventive ~~actions, however, are considered inadequate because of~~ inadvertent introduction of impurities into the system due to unacceptable levels of contaminants in the boric acid, exposure of the spent fuel pool free surface to airborne contaminants (IN 84-18), or from ingress of demineralizer resins (IN 96-11). ***(3) Parameters Monitored/Inspected:*** The system water chemistry is monitored and controlled to mitigate the effects of pitting and crevice corrosion on the intended function of the component. Examination category D-C of ASME Section XI Table IWD 2500-1 requires visual VT-2 examination during system leakage and hydrostatic test. ***(4) Detection of Aging Effects:*** ~~Within the spent fuel pool cooling system there are regions of low~~ and stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause crevice and pitting corrosion. VT-2 examination of ASME Section XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, a one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The results of periodic monitoring of borated water chemistry provide data for trending. ~~The results of the one-time inspection should be used to dictate~~ future inspection. 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:*** The chemistry monitoring program provides specification of chemical parameters and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000. ***(7) Corrective Actions:*** Plant borated water chemistry control program specifies the target values for the chemistry parameters. Corrective actions are taken if the target values are exceeded. ~~Corrective actions of the above one-time inspection are based on the results of the inspection.~~ Furthermore, IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and	[redacted]

NO

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INSERT #9
(SEE CHAPTER #11 FOR PRIMARY WATER CHEMISTRY PROGRAM)

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.1.1	Piping	Pipe, Fittings, and Flanges	Carbon Steel (CS)	Chemically Treated Borated Water	Loss of Material	General, Pitting and Crevice Corrosion	ASME Section XI, 1989 Edition. NRC IN 84-18. NRC IN 96-11. EPRI TR-10571[illegible]. NRC GL 88-05. Plant Technical Specifications.
[illegible].1	Piping	Pipe, Fittings, and Flanges	SS	Chemically Treated Borated Water	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NRC IN 84-18. NRC GL 88-05. NRC IN 97-19. EPRI TR-105714. Plant Technical Specifications.

DELETE PER VII A3-3

DELETE PER VII A3-4

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(Continued from previous page)~~ IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Pitting and crevice corrosion can occur in locations having stagnant flow or crevice conditions such ~~as socket surfaces and joints where impurities may~~ concentrate.	
Same as for Pitting and Crevice Corrosion of Item A3.1.1 piping.	*Same as for Pitting and Crevice Corrosion of Item A3.1.1 piping.* DELETE	Yes, Element 4 should be further evaluated
The AMP relies on material selection in accordance with guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steel, monitoring and maintaining water chemistry in accordance with guidelines of EPRI TR-105714 and implemented by plant technical specifications to minimize impurities, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C for systems in support of residual heat removal from spent fuel storage pool.	***(1) Scope of Program:*** The AMP relies on monitoring and maintaining the water chemistry and inservice inspection (ISI) for managing the effects of SCC on the intended function of the spent fuel pool cooling and cleanup system components. ***(2) Preventive Actions:*** Chemistry control of the levels of chloride and sulfate should minimize the rate and the effects of stress corrosion cracking. Selection of material in compliance with the requirements of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. However, preventive actions are considered inadequate because of the possible effects of inadvertent introduction of contaminants into the spent fuel pool cooling system due to contaminants in boric acid or exposure of the spent fuel pool free surface to airborne contaminants (NRC Information Notice IN 84-18). ***(3) Parameters Monitored/ Inspected:*** The parameters to be monitored are specified in EPRI TR-105714. These parameters are directly related to potential of SCC of the stainless steel components. Parameters monitored and inspected, however, should also include crack formation. ***(4) Detection of Aging Effects:*** Within the spent fuel pool cooling system, there are regions of low and stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause stress corrosion cracking. Visual examination VT-2 required by IWD 2500-1 can detect leakage, but can not detect crack. Therefore, a one-time inspection, such as the volumetric inspection specified in ASME Section XI IWC 2500-1, of representative components and susceptible locations should be undertaken to ensure that significant SCC is not occurring. Follow-up actions are based on the inspection results. ***(5) Monitoring and Trending:*** The results of periodic monitoring of borated water chemistry provide data for trending. The results of the one-time inspection should be used to dictate future inspection. Inspection schedule should be in accordance to IWC-2400 to provide timely detection of cracks before there is a loss of the intended function of the component. DELETE	Yes, Element 4 should be further evaluated

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.1.2	Piping	Studs and Nuts	CS, Low Alloy Steel (LAS)	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued of previous page)~~ **(6) Acceptance Criteria:** The chemistry monitoring program provides specification of chemical parameters and acceptable levels. Any detected SCC should be evaluated in accordance IWC-3400 and IWC-3514. **(7) Corrective Actions:** Plant borated water chemistry control program specifies the target values for the chemistry parameters. Corrective actions are taken if the target values are exceeded. Corrective actions of the above one time inspection are based on the results of the inspection. Furthermore, IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement is in accordance with IWA-4000 and IWB-4000, and reexamination in accordance with IWA-2200. **(8&9) Confirmation Process, and Administrative Controls:** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. **(10) Operating Experience:** NRC Information Notice (IN) 97-19 indicated that several through-wall cracks at piping welds have been found in spent fuel cooling system. SCC has also been found at welds in some other systems containing borated water.	
In response to NRC Generic Letter (GL) 88-05 to manage loss of material due to general corrosion, pitting and crevice corrosion on carbon steel and low alloy steel components as a result of borated water leaks, the AMP includes: (1) Identify the examination locations where boric acid leaks could occur, including insulated components and inaccessible areas. The focus is on small leaks which generally occur below technical specification limits for operational leakage. (2) Establish the path of the leaking boric acid and the components to ensure that leaks of boric acid are promptly identified and corrected. (3) Perform visual inspection at least once at each refueling outage to identify and quantify any leakage at specific locations and to remove any boric acid residue that is found. VT-2 visual examination is generally used to detect evidence of leaks such as discoloration and boric acid residue. (4) Investigate any leakage that is found and locate leak source and areas of corrosion. Evaluate the affected components for continued service by engineering analysis. Corrective actions include repair or replacement of the affected components and correction of any equipment deficiencies that cause the leaks.	**(1) Scope of Program:** The program focuses on managing loss of material due to boric acid corrosion on the carbon steel and low alloy steel components. The focus is on small leaks which generally occur below technical specification limits for operational leakage. **(2) Preventive Actions:** Periodic inspection and removal of any boric acid residue from component surface during system walkdown help to prevent the occurrence of boric acid corrosion. Identification of the potential locations of leakage and the path of leaking acid also helps to prevent borated acid corrosion. **(3) Parameters Monitored/Inspected:** The AMP performs visual inspection for discoloration of insulation and boric acid residue which are signs of boric acid leakage. Visual inspection, such as VT-2, is an effective method for identification of discoloration and boric acid residue. One or more bolts/studs (the number depends on the ASME code edition) close to the leak are removed and examined for evidence of boric acid wastage. **(4) Detection of Aging Effects:** The AMP establishes the path of the leaking boric acid and the components to ensure that leaks of boric acid are promptly identified and corrected before there is a loss of the intended function of the component. **(5) Monitoring and Trending:** The visual inspection is an effective method for detecting signs of boric water leaks. Periodic inspection provides data for trending. **(6) Acceptance Criteria:** No discoloration or boric acid residue found on surfaces of components, insulation, or floor areas that may indicate borated water leakage. No leakage of non-insulated and insulated components. **(7) Corrective Actions:** Source of leakage should be located and evaluated for corrective measures. **(8 & 9) Confirmation Process, and Administrative Controls:** Site corrective	No

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IMPLEMENTATION 88-05 — INSERT 11
(SEE CHAPTER 11 FOR GL 88-05)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THIS PROGRAM AND CORRECTION BOUNDARY.

VII AUXILIARY SYSTEMS

A3. SPENT FUEL POOL COOLING AND CLEANUP (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.2.1	Filter	Studs and Nuts	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
A3.3.1	Strainer	Studs and Nuts	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
A3.4.1	Check Valve	Body and Bonnet	SS, CS with SS Cladding	Chemically Treated Borated Water	Local Loss of Material	Pitting and Crevice Corrosion, ~~General Corrosion~~	ASME Section XI, 1989 Edition. NRC IN 84-18. NRC IN 96-11. NRC GL 88-05. EPRI TR-105714. Plant Technical Specifications.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] 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. Corrective actions include repair or replacement of the affected components and correction of any equipment deficiencies that cause the leaks. ***(10) Operating Experience:*** Leakage of borated water from bolted joints or seals has frequently caused severe ~~corrosion of carbon steel and low alloy steel components~~ such as bolts, studs, and fasteners.	
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No
The AMP relies on minimizing impurities by monitoring and maintaining the borated water chemistry in accordance with the guidelines of EPRI TR-105714 and implemented by plant technical specifications, and inservice inspection (ISI) is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C for systems in support of residual heat removal from spent fuel storage pool. VII A3-2 INSERT #9 (SEE CHAPTER #11 FOR THE PRIMARY WATER CHEMISTRY PROGRAM)	~~***(1) Scope of Program:*** The program relies on preventive~~ measures and inservice inspection (ISI) to manage the effects of pitting and crevice corrosion on the intended function of components. ***(2) Preventive Actions:*** Monitoring and maintaining the system water chemistry in accordance with the guidelines of EPRI TR-105714 helps to minimize impurities in the system fluid. Chemical parameters, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled. The preventive actions, however, are considered inadequate because of inadvertent introduction of impurities into the ~~system due to unacceptable levels of contaminants in the~~ boric acid, exposure of the spent fuel pool free surface to airborne contaminants (IN 84-18), or from ingress of demineralizer resins (IN 96-11). ***(3) Parameters Monitored/ Inspected:*** The AMP monitors chemistry parameters and the effects of corrosion by ISI to detect system water leakage. Inspection requirements of ASME Section XI, Table IWD 2500-1, category D-C specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic test of all pressure retaining Class 3 components. ***(4) Detection of Aging Effects:*** Within the spent fuel pool cooling system there are regions of low and stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause crevice ~~and pitting corrosion. VT-2 examination of ASME Section~~ XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, a one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection may be visual if the valve is disassembled, and may be covered by the plant maintenance program. UT thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring***	Yes, [redacted] SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM.

VII AUXILIARY SYSTEMS
A3. SPENT FUEL POOL COOLING AND CLEANUP (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.4.1, A3.4.2	Check Valve	Body & Bonnet (external surfaces), Studs and Nuts	Body: CS with SS lining; Studs/Nuts: CS or LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
A3.5.1	Hand Valve	Body and Bonnet	SS, CS with SS cladding	Chemically Treated Borated Water	Local Loss of Material	Pitting and Crevice Corrosion	~~ASME Section XI, [illegible] Edition.~~ NRC IN 84-18. NRC IN 96-11. NRC GL 88-05. EPRI TR 105714. Plant Technical Specifications.
A3.5.1, A3.5.2	Hand Valve	Body and Bonnet (external surfaces), Studs and Nuts	Body: CS with SS cladding; Studs/Nuts: CS or LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page) **and Trending:** The results of periodic monitoring of borated water chemistry provide data for trending. The results of the one-time inspection should be used to dictate future inspection. 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:*** The chemistry monitoring program provides specification of chemical parameters and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with acceptance standards of IWD-3000 for Class 3 components. (7) Corrective Actions: Plant borated water chemistry control program specifies the target values for the chemistry parameters. Corrective actions are taken if the target values are exceeded. Corrective actions of the above one-time inspection are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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. The potential exists for introduction of impurities into the system as contaminants in the boric acid or introduced through the free surface of spent fuel pool (IN 84–18), or from ingress of demineralizer resins (IN 96-11).~~	
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No
Same as for Pitting and Crevice Corrosion of Items A3.4.1 body and bonnet of check valve.	*Same as for Pitting and Crevice Corrosion of Items A3.4.1 body and bonnet of check valve.*	~~Yes. Element 4 should be further evaluated~~ NO
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A3.5.3	Hand Valve	Linings	Elastomers	Chemically Treated Borated Water	Hardening, Cracking	Rubber Degradation,	-
A3.6.1	Heat Exchanger	Shell	CS	~~Chemically Treated Borated Water on one side~~ Chemically Treated Demineralized Water on the other side	Loss of Material	Pitting and Crevice Corrosion, General Corrosion	~~ASME Section XI, 1989 Edition.~~ EPRI TR-105714. Plant Technical Specifications.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Long-term exposure of the rubber linings to borated water can result in rubber degradation such as, welling, hardening and cracking which, in turn, can cause corrosion of the underlying carbon steel surfaces. No existing aging management program.	An inspection program should be implemented to manage the effects of rubber degradation on the intended function of the component. The program should include sampling criteria, inspection method, inspection frequency, acceptance criteria, and corrective action. Plant specific aging management program is to be evaluated.	Yes, no existing AMP
The AMP relies on minimizing impurities by monitoring and maintaining reactor coolant and cooling water chemistry implemented by plant technical specifications, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C for systems in support of residual heat removal from spent fuel storage pool. VII A3-2 INSERT #9 (SEE CHAPTER #11 FOR PRIMARY WATER CHEMISTRY PROGRAM)	~~*(1) Scope of Program:* The program relies on monitoring~~ and maintaining reactor coolant and cooling water chemistry and inservice inspection (ISI) for managing the effects of pitting and crevice corrosion on the intended function of the component. *(2) Preventive Actions:* Monitoring and maintaining the chemistry conditions of reactor coolant and cooling water will minimize the impurities in the system fluid. The preventive actions, however, are considered inadequate because of inadvertent introduction of impurities into the system. Also, high concentration of impurities at locations having stagnant flow could cause pitting and crevice corrosion. *(3) Parameters Monitored/Inspected:* The parameters monitored in the borated water are provided in the specifications based on EPRI guidelines. The parameters ~~include dissolved iron, dissolved copper, chlorides,~~ dissolved oxygen, suspended solids, pH, and hydrazine. Examination category D-C of ASME Section XI Table IWD 2500-1 requires visual VT-2 examination during system leakage test and system hydrostatic test to detect the leakage. *(4) Detection of Aging Effects:* Within the spent fuel pool cooling system, there are regions of low and stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause pitting and crevice corrosion. Visual examination VT-2 required by IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, a one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion ~~is not occurring. Based on piping/component geometry~~ and fluid flow conditions, susceptible locations can be identified. Follow up actions are based on inspection results and plant technical specification. *(5) Monitoring and Trending:* The results of periodic monitoring of borated water chemistry provide data for trending. The results of the one-time inspection should be used to dictate future inspection. 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:* The chemistry monitoring program provides specification of chemical ~~parameters and acceptable levels. Any relevant conditions~~ that may be detected during the leakage and hydrostatic tests are evaluated in accordance with acceptance standards of IWD-3000 for Class 3 components. *(7) Corrective Actions:* Plant borated water chemistry control program specifies the target values for the chemistry parameters. Corrective actions are taken if the target values are exceeded. Corrective actions of the above one-time inspection are based on the results of the	Yes, ~~Plant specific should be further evaluated~~

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.6.1 thru A3.6.3	Heat Exchanger	Shell, Nozzles (external surface), Studs and Nuts	CS, LAS	Air, leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
A3.7.1	Ion Exchanger	Studs and Nuts	CS, LAS	Air, leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
A3.8.1	Pump	Casing	SS, CS with SS Cladding	Chemically Treated Borated Water	Loss of Material	Pitting ~~and~~ Crevice Corrosion~~, Cavitation Erosion~~	~~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.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement of the corrosive damaged components are in accordance with IWA-4000 and IWA-7000. ***(8 & 9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR ~~Part 50 requirements and will continue to be adequate for~~ license renewal. ***(10) Operating Experience:*** ~~Localized~~ corrosion can occur at crevices that are not exposed to the general flow stream or under stagnant flow conditions, such as at the tubesheet-shell joint, and other crevices in the shell side of heat exchanger exposed to the chemically ~~treated demineralized water.~~	
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No
The AMP relies on monitoring and maintaining water chemistry based on guidelines of EPRI TR-105714 and implemented by plant technical specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C, and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 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. VII A3-2 INSERT #9 (SEE CHAPTER #11 FOR PRIMARY WATER CHEMISTRY PROGRAM)	***(1) Scope of Program:*** The program relies on preventive measures and inservice inspection (ISI) and inservice testing (IST) to manage the effects of pitting corrosion, crevice corrosion, and cavitation erosion on the intended function of the components. ***(2) Preventive Actions:*** Monitoring and maintaining system water chemistry helps minimizing impurities in the system fluid. The AMP generally contains chemical parameter specifications, sampling frequency, analysis, and corrective actions. Chemical parameters, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled in accordance with plant's technical specification. In some case, the preventive actions may be considered inadequate because of inadvertent introduction of impurities into the system due to unacceptable levels of contaminants in the boric acid, exposure of the spent fuel pool free surface to airborne contaminants (IN 84-18), or from ingress of demineralizer resins (IN 96-11). ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of corrosion and cavitation erosion by ISI to detect leakage and IST to evaluate component performance. Inspection requirements of ASME Section XI, Table IWD 2500-1, category D-C specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic tests. ***(4) Detection of Aging Effects:*** Within the spent fuel pool cooling system, there are regions of low and stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause pitting and crevice corrosion. Visual examination VT-2 required by IWD 2500-1 will not	Yes, ~~Element 4 should be further evaluated~~

(SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.8.1, A3.8.2	Pump	Casing (external surface), Studs and Nuts	Casing: CS with SS cladding; Studs/Nuts: CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
A.3.9.1	Flow Orifice	Studs and Nuts	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
A3. 10.1	Spent Fuel Transfer Tube	Studs and Nuts	CS, LAS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) detect pitting corrosion, crevice corrosion, and cavitation erosion. Therefore, a one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual when the pump is disassembled, and may be covered by the plant maintenance program; UT thickness measurements may also be included. Follow-up actions are based on the results of the one-time inspection. ***(5) Monitoring and Trending:*** The results of periodic monitoring of borated water chemistry provide data for trending. The results of the one-time inspection should be used to dictate future inspection. 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:*** The chemistry monitoring program provides specification of chemical parameters and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Plant borated water chemistry control program specifies the target values for the chemistry parameters. Corrective actions are taken if the target values are exceeded. Corrective actions of the above one-time inspection are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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 flange connections and crevices where buildup of impurities can occur. Also, the potential exists for introduction of impurities into the system as contaminants in the boric acid or introduced through the free surface of spent fuel pool (IN 84-18), or from ingress of demineralizer resins (IN 96-11).	
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No
Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.	*Same as for Boric Acid Corrosion of Item A3.1.2 piping studs and nuts.*	No

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIA.3

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT/ RESOLUTION
VII A3-1	Spent Fuel Cooling and Cleanup	A3	VII A3-3		Description of system, structures and components is for Spent Fuel Storage and not Spent Fuel Cooling and Cleanup. Revise accordingly. Same comment for System Interfaces.
VII A3-2	Spent Fuel Cooling and Cleanup	A3.1.1 A3.4.1 A3.5.1 A3.6.1 A3.8.1	VII A3-4 thru VII A3-7 VII A3-9 thru VII A3-17 VII A3-19		Use of Chemistry will preclude loss of material due to corrosion in the Spent fuel Pool Cooling and Cleanup System. Reference to ASME Section XI, Tech Specs, OM Code and GL 89-04 should be deleted from the References column, the Existing AMP column, and the Evaluation and Technical Basis column. The AMA should only be the "*Primary Water Chemistry Program.*" Refer to the proposed program description. Hence, further evaluation is not warranted.
VII A3-3	Spent Fuel Cooling and Cleanup	A3.1.1	VII A3-6		For Carbon Steel material delete entire Section. There are no spent fuel systems that use carbon steel piping with borated water.
VII A3-4	Spent Fuel Cooling and Cleanup	A3.1.1	VII A3-6		For SS material and Stress Corrosion Cracking delete entire section. Stainless steels that operate at temperature <140^{0}F are not usually subjected to SCC even in the presence of halogens, sulfates and oxygen. Spent Fuel Cooling systems usually operate at <140^{0}F.
VII A3-5	Spent Fuel Cooling and Cleanup	A3.1.2 A3.2.1 A3.3.1 A3.4.1 A3.4.2 A3.5.1 A3.5.2 A3.6.1 thru A3.6.3 A3.7.1 A3.8.1 A3.8.2 A3.9.1 A3.10.1	Various		Refer to AMA titled, "*Boric Acid Corrosion Program*" in lieu of existing program description. Refer to the proposed program description.

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIA.3

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT/ RESOLUTION
VII A3-6	Spent Fuel Cooling and Cleanup	A3.4.1	VII A3-10		Item appears to be limited to internal surfaces of clad carbon steel check valves exposed to borated water. Under Aging Mechanisms, delete general corrosion, since stainless steel cladding surfaces are not subjected to general corrosion. The external surfaces of this valve are evaluated in Item A3.4.2.
VII A3-7	Spent Fuel Cooling and Cleanup	A3.6.1	VII A3-14		Under Environment delete chemically treated borated water. The carbon steel components of subject heat exchangers are subjected only to chemically treated demineralized water.
VII A3-8	Spent Fuel Cooling and Cleanup	A3.8.1	VII A3-16		Delete cavitation erosion under Aging Mechanisms. Pump design/application standards should preclude the occurrence of this mechanism. In any event if it were to occur, it would be fast acting, easily detectable because of the noise generated, and would result in reduced performance.

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

A4.1 Piping

A4.1.1 Pipe, Fittings and Flanges

A4.2 Valves

A4.2.1 Body and Bonnet

A4.3 Heat Exchanger

A4.3.1 Shell

A4.4 Pump

A4.4.1 Casing

VII A4-1

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

System, Structures, and Components

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

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

System Interfaces

The system that interfaces with the BWR spent fuel cooling and cleanup system is the closed cycle cooling water system (Table VII C2).

VII AUXILIARY SYSTEMS

A4. SPENT FUEL POOL COOLING AND CLEANUP (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A4.1.1	Piping	Pipe, Fittings, and Flanges	Stainless Steel (SS)	Oxygenated Water at Tempera-ture up to 51°C (125°F)	Loss of Material	Pitting and Crevice Corrosion	[redacted] NUREG-0313, Rev. 2. Plant Technical Specifications. EPRI-103515

VII A4-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on minimizing impurities by monitoring and maintaining the oxygenated water chemistry in accordance with the guidelines of NUREG 0313, Rev. 2 and EPRI guidelines and implemented by plant technical specifications, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination-category D-C for systems in support of residual heat removal from spent fuel storage pool. VII A4-2 INSERT #9 (SEE CHAPTER #11 FOR THE PRIMARY WATER CHEMISTRY PROGRAM)	~~(1) Scope of Program: The AMP relies on monitoring and maintaining the chemistry of the oxygenated water and ASME Section XI inservice inspection (ISI) for managing the effects of pitting and crevice corrosion on intended function of the component. (2) Preventive Actions: Monitoring and maintaining the system water chemistry in accordance with the guidelines of NUREG 0313, Rev. 2 and EPRI guidelines specified in TR-103515 to minimize the impurities in the system fluid. Parameters directly related to corrosion, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled. (3) Parameters Monitored/Inspected: ASME Section XI, Table IWD 2500-1, examination category D-C requires visual VT-2 examination during system leakage test and system hydrostatic test to detect the leakage. (4) Detection of Aging Effects: Pitting and crevice corrosion may occur at locations having stagnant flow conditions, where impurities in oxygenated water may concentrate. VT-2 examination of ASME Section XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, an one time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified. Follow up actions are based on the inspection results and plant technical specification. (5) Monitoring and Trending: Results of water chemistry monitoring provides data for trending. The results of one time inspection should be used to dictate the future inspection. System leakage test is conducted prior to plant startup following each refueling outage and hydrostatic test at or near the end of each. (6) Acceptance Criteria: The chemistry monitoring program provides chemical parameter specification and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000. (7) Corrective Actions: Plant chemistry control program specifies the acceptable values for chemistry parameters. If the specified values are exceeded, corrective actions are taken to bring back the chemistry parameters to specified levels. Corrective actions of the above one time inspections are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and IWA-7000. (8 & 9) Confirmation Process and Administrative Controls: Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. (10) Operating Experience Pitting and crevice corrosion may occur at locations having stagnant flow conditions, where impurities in oxygenated water may concentrate.~~	Yes. [redacted] SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM

VII AUXILIARY SYSTEMS

A4. SPENT FUEL POOL COOLING AND CLEANUP (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A4.1.1	Piping	Pipe, Fittings, and Flanges	Stainless Steel (SS)	Oxygenated Water at Tempera-ture up to 51°C (125°F)	Crack Initiation and Growth	Stress Corrosion Cracking	ASME Section XI, 1989 Edition. NUREG-0313, Rev. 2. Plant Technical Specifications. EPRI-103515
A4.2.1	Valves	Body and Bonnet	SS, CS with SS Cladding; CS or LAS	Oxygenated Water at Tempera-ture up to 51°C (125°F)	Loss of Material	Pitting and Crevice Corrosion	~~ASME Section XI, 1989 Edition.~~ NUREG 0313, Rev. 2. Plant Technical Specifications. EPRI TR-103515

VII A4-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for Pitting and Crevice Corrosion of Item A.4.1.1 Piping.	*Same as for Pitting and Crevice Corrosion of Item A.4.1.1 Piping.*	Yes, Element 4 should be further evaluated
The AMP relies on minimizing impurities by monitoring and maintaining the oxygenated water chemistry in accordance with the guidelines of NUREG 0313, Rev. 2 and EPRI guidelines and implemented by plant technical specifications, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C for systems in support of residual heat removal from spent fuel storage pool. VII A4-2 INSERT #9 (SEE CHAPTER #11 FOR THE PRIMARY WATER CHEMISTRY PROGRAM)	~~***(1) Scope of Program:*** The program relies on preventive~~ measures and inservice inspection (ISI) to manage the effects of pitting and crevice corrosion on the component. ***(2) Preventive Actions:*** Chemical parameters, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled in accordance with the guidelines of NUREG-0313 and EPRI guidelines specified in TR-103515. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by ISI to detect system leakage. Inspection requirements of ASME Section XI, Table IWD 2500-1, category D-C specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 3 components. ***(4) Detection of Aging Effects:*** Pitting ~~and crevice corrosion may occur at locations having~~ stagnant flow conditions, where impurities in oxygenated water may concentrate. VT-2 examination of ASME Section XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, an one time inspection of representative valves and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection may be visual if the valve is disassembled. UT thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** Results of water chemistry monitoring provides data for trending. The results of one time inspection ~~should be used to dictate the future inspection.~~ 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:*** The chemistry monitoring program provides chemical parameter specification and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with acceptance standards of IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Plant chemistry control program specifies the acceptable values for chemistry parameters. If the specified values are exceeded corrective actions are taken to bring back the chemistry parameters to specified levels. Corrective actions of the ~~above one time inspections are based on the results of the~~ inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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	Yes, ~~Element 4 should be further evaluated~~

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

VII AUXILIARY SYSTEMS

A4. SPENT FUEL POOL COOLING AND CLEANUP (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A4.3.1	Heat Exchanger	Shell	CS	Oxygenated Water at Temperature up to 51°C (125°F)	Loss of Material	General Corrosion, Pitting and Crevice Corrosion,	ASME Section XI, 1989 Edition. Plant Technical Specifications. EPRI TR-103515

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) 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 build up of impurities can occur.	
The AMP relies on minimizing impurities by monitoring and maintaining the system water chemistry implemented by plant technical specifications, and inservice inspection (ISI) is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C for systems in support of residual heat removal from spent fuel storage pool. VII A4-2 INSERT #9 (SEE CHAPTER #11. FOR THE PRIMARY WATER CHEMISTRY PROGRAM)	***(1) Scope of Program:*** The program relies on monitoring and maintaining the chemistry conditions of the system water for managing the effects of pitting and crevice corrosion on the intended function of the component. ***(2) Preventive Actions:*** Monitoring and maintaining the system water chemistry in accordance with the guidelines of NUREG 0313, Rev. 2 and EPRI guidelines specified in TR-103515 minimize the impurities in the system fluid. Parameters directly related to corrosion, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled. ***(3) Parameters Monitored/Inspected:*** The parameters monitored include dissolved iron, dissolved copper, chlorides, dissolved oxygen, suspended solids, pH, and hydrazine. Dissolved iron and copper are parameters directly related to corrosion. Examination category D-B of ASME Section XI Table IWD 2500-1 requires visual VT-2 examination during system leakage test and system hydrostatic test to detect the leakage. However, high concentration of impurities at locations having stagnant flow could cause pitting and crevice corrosion. ***(4) Detection of Aging Effects:*** Visual examination VT-2 required by IWD 2500-1 can detect and identify the leakage, but can not detect pitting and crevice corrosion. Therefore, inspection at susceptible locations should be undertaken to ensure that significant corrosion is not occurring. ***(5) Monitoring and Trending:*** The frequency of monitoring system water chemistry ranges from several times per week to once a month. The results of monitoring should provide data for trending. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides chemical parameter specification and acceptable levels. Any significant degradation is reported and requires further evaluation. ***(7) Corrective Actions:*** The AMP contains chemical parameter specifications, sampling frequency, analysis and corrective actions. If the specified values are exceeded, corrective actions are initiated to bring back the chemistry parameters to specified levels. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Corrosion and pitting can occur at the crevices that are not exposed to the general flow stream or under stagnant flow conditions, such as at the tubesheet-shell joint, and other crevices in the shell side of heat exchanger.	~~Yes, Element 4 should be further evaluated~~

SEE CHAPTER XI FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM.

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
A4.4.1	Pump	Casing	SS, CS with SS Cladding	Oxygenated Water at Temperature up to 51°C (125°F)	Loss of Material	Pitting and Crevice Corrosion	~~ASME Section XI, 1989 Edition. ASME OM Code-~~ [redacted] NUREG-0313 Rev. 2. NRC GL 89-04. Plant Technical Specifications. EPRI TR-103515

VII A4-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The applicable AMP relies on minimizing impurities by monitoring and maintaining water chemistry conditions in accordance with the guidelines of NUREG- 0313, Rev. 2, and EPRI guidelines and implemented by the plant technical specifications and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-C, and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 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. VII A4-2 INSERT #9 (SEE CHAPTER #11 FOR THE PRIMARY WATER CHEMISTRY PROGRAM)	~~(1) Scope of Program: The program relies on preventive~~ measures and inservice inspection (ISI) and inservice testing (IST) to manage the effects of pitting and crevice corrosion on the component. ***(2) Preventive Actions:*** Monitoring and maintaining the system water chemistry in accordance with EPRI guidelines to minimize impurities in the system fluid. The AMP generally contains chemical parameter specifications, sampling frequency, analysis, and corrective actions. Chemical parameters, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by ISI to detect system water leakage and IST to evaluate component performance. ~~Inspection requirements of ASME Section XI, Table IWD-~~ 2500-1, category D-C specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic test of all pressure retaining Class 3 components. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 pumps and 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:*** Pitting and crevice corrosion may occur at locations having stagnant flow conditions, where impurities in oxygenated water may concentrate. VT-2 examination of Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, an one time inspection ~~of representative valves and susceptible locations~~ should be undertaken to ensure that significant corrosion is not occurring. This inspection may be visual if the valve is disassembled. UT thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** Results of water chemistry monitoring provides data for trending. The results of one time inspection should be used to dictate the future inspection. 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:*** The chemistry monitoring program provides~~ chemical parameter specification and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** :Plant chemistry control program specifies the acceptable values for chemistry parameters. Corrective actions are taken when specified values are exceeded. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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 flange connections and crevices where buildup of impurities can occur.	Yes, ~~Element 4 should be further evaluated~~

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

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION VIIA.4

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VII A4-1	SFPC (BWR)	All			This SYSTEM is not in scope for all BWRs
VII A4-2		A4.1.1 A4.2.1 A4.3.1 A4.4.1	VII A4-5 Thru VII A4-11		Use of Chemistry will preclude loss of material due to corrosion in the Spent fuel Pool Cooling and Cleanup System. Reference to ASME Section XI, Tech Specs, OM Code and GL 89-04 should be deleted from the References column, the Existing AMP column, and the Evaluation and Technical Basis column. The AMA should only be the "*Primary Water Chemistry Program.*" Refer to the proposed program description. Hence, further evaluation is not warranted.

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

C1.1 Piping

C1.1.1 Piping and Fittings

C1.1.2 Underground Piping and Fittings

C1.2 Valves

C1.2.1 Body and Bonnet

C1.3 Heat Exchanger

C1.3.1 Shell

C1.3.2 Channel

C1.3.3 Channel Head

C1.3.4 Tube Sheets

C1.3.5 Tubes

C1.4 Flow Orifice

C1.4.1 Body

C1.5 Pump

C1.5.1 Casing

C1.6 Basket Strainer

C1.6.1 Body

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

System, Structures, and Components

The system, structures, and components included in this table comprise the open cycle cooling water system which consists of piping, valves, heat exchangers, pumps, flow orifices, and basket strainers. The system contains raw untreated salt or fresh water. The system removes heat from the closed cycle cooling water system and, in some plants, other auxiliary systems and components such as steam turbine bearing oil coolers, or miscellaneous coolers in the condensate system. The heat is absorbed by the ultimate heat sink such as a cooling pond, cooling tower, river, lake, or sea. This table only addresses the heat exchangers for removing heat from the closed cycle cooling system; heat exchangers for removing heat from other auxiliary systems and components are addressed in their respective systems, such as Table VIII A for steam turbine bearing oil coolers and Table VIII E for condensate system coolers. Based on 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 open cycle cooling water system are classified as Group C Quality Standards.

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

System Interfaces

The systems that interface with the open cycle cooling water system include the closed cycle cooling water system (Table VII C2), ultimate heat sink (Table VII C3), and other miscellaneous auxiliary systems and components.

VII AUXILIARY SYSTEMS

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

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C1.1.1	Piping	Piping and Fittings (with or without Internal Lining or Coating)	Brass, Copper-Nickel, Carbon Steel (for fresh water only)	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, Micro-biologically-Induced, Pitting, and Crevice Corrosion.	~~ASME Section XI, 1989 Edition~~ NRC IN 94-03, GL 89-13.

VIIC1-3

VIIC1-1

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on preventive actions by selection of corrosion resistant materials, design with corrosion allowance or provision of corrosion resistant interior lining or coating, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components. In addition, GL 89-13 requires that a program must be implemented and maintained for surveillance and control of flow blockage as a result of biofouling. It also requires that the heat transfer capability be verified for all safety-related heat exchangers cooled by service water system. VII C1-1 INSERT # 12 FOR GL89-13 (SEE CHAPTER #11)	~~*(1) Scope of Program:* The AMP relies on selection of~~ corrosion resistant materials, corrosion allowance or corrosion resistant lining or coating, and ASME Section XI inservice inspection (ISI) for managing the effects of corrosion on the intended function of the component. The AMP also relies on the proper implementation of GL 89-13. ***(2) Preventive Actions:*** The component is constructed of corrosion resistant materials such as red brass, copper-nickel, AL6XN, or titanium. Lining or coating prevents corrosion by protecting the underlying metal surfaces from being exposed to corrosive environment, and unprotected piping, e.g., carbon steel used for fresh water systems, are designed with a corrosion allowance. Also, an active biofouling ~~program is in place for surveillance~~ and control of flow blockage. ***(3) Parameters Monitored/Inspected:*** ASME Section XI, Table IWD-2500-1, category D-B requires visual VT-2 examination during system leakage and hydrostatic test to detect leakage. The biofouling program implemented in accordance to GL 89-13 provides surveillance for flow blockage and verification of the heat transfer capability for all safety-related heat exchangers cooled by service water system. ***(4) Detection of Aging Effects:*** Concentration of sulfates and chlorides in salt water can cause pitting and corrosion under crevice conditions such as gasket surfaces, joints, and under bolt heads. Also, systems that use untreated water are susceptible to microbiologically-induced corrosion. ~~VT-2 examination during system leakage and~~ pressure tests will not detect these forms of corrosion. Therefore, a one-time inspection of representative components and susceptible locations including buried piping should be undertaken to ensure that significant corrosion is not occurring. Based on piping or component geometry, fluid flow conditions, lowest design margin, and time of service, susceptible locations can be identified. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The results of one time inspection should be used to dictate future inspection. 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 IWD-3000. ***(7) Corrective Actions:*** Corrective actions of the above one-time inspection are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50	~~Yes, Element 4 should be further evaluated.~~ SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE APPLICATION OF GL-89-13

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.1.1	Piping	Piping and Fittings (with or without Internal Lining or Coating)	Brass, Copper-Nickel, Carbon Steel (for fresh water only)	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	NRC GL 89-13. NRC IN 94-03.
C1.1.2	Piping	Underground Piping and Fittings (External Surface)	Carbon Steel, Cast Iron (with Organic Coating or Wrapping)	Soil	Loss of Material	General, Galvanic, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 94-03.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(Continued from previous page)~~ requirements and will continue to be adequate for license renewal. *(10) Operating Experience:* Pitting and crevice corrosion may occur at locations having stagnant flow conditions, where impurities in raw and fresh water may concentrate. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.	
In response to NRC Generic Letter (GL) 89-13, industry implemented surveillance and control program to manage flow blockage problems in open-cycle service water system due to biofouling, silt, mud, and corrosion products. The program generally includes: (1) Sampling the water annually to determine if the biological species have populated the water source. The system should be chlorinated or treated by biocide when the potential of biological species exists; (2) inspect, on a regular basis, sensitive portions of the piping and components for biofouling; (3) remove and clean excessive accumulation of biofouling products; and (4) monitoring heat exchanger performance. GL 89-13 requires that a program must be implemented and maintained for surveillance and control of flow blockage as a result of biofouling. It also requires that the heat transfer capability be verified for all safety-related heat exchangers cooled by service water system.	~~*(1) Scope of Program:* The program is focused on~~ managing the aging effects of biofouling on the intended functions of the component. The AMP also relies on the proper implementation of GL 89-13. *(2) Preventive Actions:* Annual water sampling and treatment of biocide should reduce the level of macroorganism activities. *(3) Parameters Monitored/Inspected:* The biofouling program implemented in accordance to GL 89-13 requires verification of the heat transfer capability for all safety-related heat exchanges cooled by service water system. The AMP also inspects sensitive portions of the piping and components for biofouling. *(4) Detection of Aging Effects:* ~~Visual inspection should detect buildup of deposit due to~~ befouling. *(5) Monitoring and Trending:* Periodic inspection should provide timely detection of the effects of biofouling. *(6) Acceptance Criteria:* Any significant degradation is reported and requires further evaluation. *(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:* ~~Extensive flow blockage by clams has caused~~ plant shutdown. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.	No SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR APPLICATION OF GL 89-13
~~The external surfaces of the~~ underground piping and fittings are protected, per standard industry practice, with external coating and wrapping, and a cathodic protection system. Other suitable means may be used to monitor the condition of underground piping.	*(1) Scope of Program:* The program relies on preventive measures such as coating, wrapping, and cathodic protection, for managing the effects of corrosion on the intended function of underground piping. *(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 protection of piping from contacting with aggressive soil environment. A cathodic protection system may also be used to mitigate corrosion by counteracting galvanic activity. If method other than coating and cathodic protection are used, these methods should be described. *(3) Parameters Monitored/ Inspected:* The effectiveness of the coatings and cathodic protection system, per industry standard practice, is determined by measuring coating conductance, by pipe-to-soil potential surveys, and by conducting bell hole examinations to visually examine the condition of the coating. PLANT SPECIFIC PER VII C1-4	Yes, ~~Elements 3 through 6 should be further evaluated.~~

VII C1-1 INSERT #12 (SEE CHAPTER #11)

VII AUXILIARY SYSTEMS

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.2.1	Valves (Check, Hand, & Control Valves)	Body and Bonnet (with or without Internal Lining or Coating)	Bronze, Stainless Steel, Carbon Steel (for fresh water only)	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	NRC GL 89-13. NRC IN 94-03.

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VII AUXILIARY SYSTEMS

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Pitting and crevice corrosion may occur at locations having stagnant flow conditions, where impurities in raw and fresh water [illegible] concentrate. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.	
INSERT #12 insert 1 In response to [illegible] Generic Letter (GL) 89-13, industry [illegible] surveillance and [illegible] program to manage flow blockage problems in open-cycle service water system due to biofouling, silt, mud, and corrosion products. The program [illegible] includes: (1) Sampling the [illegible] annually to determine if the [illegible] species have populated the water source. The system should be chlorinated or treated by biocide when the potential of biological species exists; (2) inspect, on a regular basis, sensitive portions of [illegible] piping and components for biofouling; (3) remove and clean excessive accumulation of biofouling products; and (4) monitoring heat exchanger performance. GL 89-13 requires that a program must be implemented and maintained for surveillance and control of flow blockage as a result of biofouling. [illegible] requires that the heat transfer capability be verified for all safety-related heat exchangers cooled by service water system.	***(1) Scope of Program:*** The program is focu[illegible] managing the aging effects of biofouling [illegible] intended functions of the component. The AMP [illegible] relies on the proper implementation of GL 89-13. ***[illegible] Preventive Actions:*** Annual water sampling and treatment of biocide should reduce the level of macro[illegible] activities. ***(3) Parameters Monitored/Inspe[illegible]:*** The biofouling program implemented in accordance to GL 89-13 requires verification of the heat transfer capability for all safety-related heat exchanges [illegible] by service water system. The AMP also inspects sensitive portions of the piping and components for biofouling. ***(4) Detection of Aging Effects:*** Visual inspection should detect buildup of deposit due to biofouling. ***(5) Monitoring and Trending:*** Periodic inspection should provide timely detection of the effects of [illegible]. ***(6) Acceptance Criteria:*** Any significant degradation is reported and requires further evaluation. ***(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:*** Ex[illegible] flow blockage by clams has caused plant shutdown. [illegible] NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.	No
The external surfaces of the underground piping and fittings [illegible] protected, per standard industry practice, with external coating and wrapping, and a cathodic protection system. Other suitable means may be used to monitor the condition of underground piping. "Plant specific AMP" comment	***(1)Scope of Program:*** [illegible] program relies on preventive measures such as coating, [illegible], and cathodic protection, for [illegible] the [illegible] of corrosion on the intended function of underground piping. ***(2) Preventive Actions:*** Per industry practice, [illegible] piping is coated with protective coating [illegible] tar or synthetic coating, and is [illegible] with protective paper or plastic during installation for protection [illegible] from contacting [illegible] aggressive soil environment. A cathodic protection system may [illegible] be used to mi[illegible] corrosion by counteracting galvanic activity. If methods other than coating and cathodic protection are used, these methods must be described. ***(3) Parameters Monitored/ In[illegible]:*** The effectiveness of the coatings and cathodic pro[illegible] system, per industry standard practice, is determined [illegible] measuring coating conductance, by pipe-to-soil poten[illegible] surveys, and by conducting bell hole examinations to visually examine the condition of the coating. DELETE	Yes, [redacted] Yes, Plant specific AMP

VII C1-4

VII AUXILIARY SYSTEMS

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.2.1	Valves (Check, Hand, & Control Valves)	Body and Bonnet (with or without Internal Lining or Coating)	Bronze, Stainless Steel, Carbon Steel (for fresh water only)	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, Micro-biologically-Induced, Pitting, and Crevice Corrosion.	[redacted] NRC IN 94-03. Plant Technical Specifications. GL 89-13. Comment VIIC1-1

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) Coating ~~and wrapping, however, can degrade with time~~ and corrosion may occur. Also, cathodic protection requires periodic monitoring and maintenance to ensure that it is functioning properly. The AMP should include inspection of a sample of the buried piping to ensure that coating and wrapping are intact and corrosion is adequately managed. Also, a monitoring maintenance program should be implemented to ensure that cathodic protection is functioning properly. ***(4) Detection of Aging Effects:*** An increase in conductance or the indication that certain portions of the piping are not adequately protected indicates coating degradation. Inspection of a sample of the buried pipe and confirmation that the paint or coating is intact is an effective method to ensure that corrosion on external surfaces of the pipe has not occurred and the intended functions are maintained. ***(5) Monitoring and Trending:*** The effects of corrosion are detected by visual techniques and, based on operating experience, inspection of a sample of the buried pipe should provide for timely detection of aging effects. ***(6) Acceptance Criteria:*** In accordance with acceptable industry practice, the assessment of the condition of the coating by conductance and cathodic protection system measurements should be conducted on an annual basis. Monitoring coating conductance ~~or current versus time will give an indication~~ of the conditions of the coating and cathodic protection system. ***(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:*** A one-inch diameter hole with pit walls steeply tapered from the outer diameter inward has been discovered in an underground piping with 20 years of operation. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03. DELETE	
The AMP relies on preventive actions by selection of corrosion resistant materials, design with corrosion allowance or provision of corrosion resistant interior lining or coating, and inservice inspection (ISI) in conformance with ASME Section XI (Edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components.	***(1) Scope of Program:*** The AMP relies on selection of corrosion resistant materials, corrosion allowance or corrosion resistant lining or coating, and ASME Section XI inservice inspection (ISI) for managing the effects of corrosion on the intended function of the component. The AMP also relies on the proper implementation of GL 89-13. ***(2) Preventive Actions:*** The component is constructed of corrosion resistant materials; lining or coating prevents corrosion by protecting the underlying metal surfaces from being exposed to corrosive environment, and unprotected piping (carbon steel used for fresh water systems) are designed with a corrosion allowance.	Yes, [redacted]

GL 89-13 AMA
See Insert #12

VII AUXILIARY SYSTEMS

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.2.1	Valves (Check, Hand, & Control Valves)	Body and Bonnet (with or without Internal Lining or Coating)	Bronze, Stainless Steel, Carbon Steel (for fresh water only)	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	NRC GL 89-13. NRC IN 94-03.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) ***(3) Parameters Monitored/ Inspected:*** ASME Section XI, Table IWD 2500-1, category D-B, requires visual VT-2 examination during system leakage and hydrostatic test. ***(4) Detection of Aging Effects:*** Concentration of sulfates and chlorides in salt water can cause pitting and corrosion under crevice conditions such as gasket surfaces, joints, and under bolt heads. Also, systems that use untreated water are susceptible to microbiologically-induced corrosion. VT-2 examination during system leakage and pressure tests will not detect these forms of corrosion. Therefore, a one-time inspection of representative components at susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual if the valve is disassembled, and may be covered by the plant maintenance program. UT thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The results of one time inspection should be used to dictate the future inspection. 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 IWD-3000. ***(7) Corrective Actions:*** Corrective actions of the above one time inspection are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Pitting and crevice corrosion may occur at locations having stagnant flow conditions, where impurities in raw and fresh water may concentrate. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.	SEE CHAPTER XI FOR EVALUATION AND TECHNICAL BASES FOR APPLICATION OF GL-89-13.
Same as for the effect of Biofouling on Item C1.1.1 piping and fittings.	*Same as for the effect of Biofouling on Item C1.1.1 piping and fittings.*	No

VII AUXILIARY SYSTEMS

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.3.1 thru C1.3.5	Heat Exchanger (between open cycle and closed cycle cooling water systems)	Shell, Channel, Channel Head, Tube Sheet, Tubes	Shell, Channel, Channel Head: Carbon Steel; Tube sheet: Aluminum-Bronze; Tubes: Copper-Nickel	Shell Side: Treated Water; Tube Side: Raw Untreated Salt or Fresh Water	Loss of Material	General, Microbio-logically-Influenced, Pitting, and Crevice Corrosion	NRC GL 89-13. 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.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
For shell side of the heat exchanger exposed to treated water the AMP rely on preventive measures to mitigate corrosion by monitoring and control of the water chemistry to minimize exposure to aggressive environments. For tube side of the heat exchanger exposed to untreated salt or fresh water the subcomponents are either protected by corrosion resistant lining or coating such as channel heads lined with rubber/neoprene or coated with epoxy, or are constructed by corrosion resistant materials such as aluminum-bronze, copper-nickel, brass, and stainless steel. Visual inspection, cleaning, and testing, e.g., eddy current, of tubes are performed periodically to verify that degradation has not occurred. Corrective actions are taken, if significant degradation is found. In addition, GL 89-13 requires that a program must be implemented and maintained for surveillance and control of flow blockage as a result of biofouling. It also requires that the heat transfer capability be verified for all safety-related heat exchangers cooled by service water system.	~~***(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 provides 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 of all heat exchangers cooled by service water, (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 practice and procedures. The AMP relies on the proper ~~implementation of GL 89-13. ***(2) Preventive Actions:*** For~~ shell side, control of water chemistry should mitigate corrosion. For tube side, lining or coating should prevent corrosion by protecting the underlying metal from aggressive environment such as salt water. Based on GL 89-13 service water is continuously chlorinated or treated with biocide whenever the potential for biological fouling species exists. ***(3) Parameters Monitored/Inspected:*** For the shell side exposed to treated water, the parameters monitored generally include dissolved iron, dissolved copper, dissolved oxygen, chloride, suspended solids, etc. These parameters are directly related to corrosion. The program also provides control of the concentrations of oxygen, chlorides, other chemicals, and contaminants. For the tube side exposed to salt or fresh water, corrosion ~~of underlying metal will not occur without failure of~~ lining or coating. Inspection of rubber lining or coating for signs of degradation such as elastomer degradation ensures that corrosion is not occurring. Based on GL 89-13 or its equivalent, open-cycle 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 occur. ***(4) Detection of Aging Effects:*** Monitoring of dissolved iron, dissolved copper, and suspended solids should detect the existence of general and microbiologically-induced corrosion in shell side of the heat exchanger. Plant operating experience confirms ~~the copper and iron monitoring~~ has resulted in extremely low corrosion rates of steel and copper alloys in the system. For the tube side, periodic inspection of subcomponents and performance evaluation by eddy current testing should detect occurrence of corrosion. ***(5) Monitoring and Trending:*** Effects of corrosion are detectable by iron and copper monitoring and periodic inspections should provide for timely detection of aging effects on both shell and tube sides of the heat exchanger. The frequency of monitoring of treated water usually	No

VII C1-2

INSERT #12
(SEE CHAPTER #11 FOR OPEN CYCLE COOLING WATER SYSTEM INSPECT GL89-13

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE OPEN CYCLE COOLING WATER SYSTEM INSPECTIONS (GL-89-13).

VII AUXILIARY SYSTEMS

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.3.1 thru C1.3.5	Heat Exchanger (between open cycle and closed cycle cooling water systems)	Shell, Channel, Channel Head, Tube Sheets, Tubes	Shell, channel, and channel head: carbon steel; Tube sheet: aluminum-bronze; Tubes: copper-nickel	Shell Side: Treated Water; Tube Side: Raw Untreated Salt or Fresh Water	Buildup of Deposit	Biofouling, [redacted]	NRC GL 89-13. NRC IN 94-03.

VIIC1-5

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) ranges from several times per week to once a month. Water chemistry monitoring provides data for trending. Results from performance tests to verify heat transfer capabilities are also trended. ***(6) Acceptance Criteria:*** Any signs of degradation and corrosion should be reported and evaluated. Any lining degradation should be repaired. The water chemistry control program provides specification of chemical parameters and acceptable levels. ***(7) Corrective Actions;*** Plant chemistry control program specifies target values for parameters in the treated water. If the specified values are exceeded, corrective actions are initiated to return the chemistry parameters to normal levels. ***(8 & 9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls should be implemented in accordance with Appendix B to 10 CFR Part 50 requirements and should continue for license renewal. ***(10) Operating Experience:*** Significant microbiologically-influenced corrosion (NRC Information Notice (IN) 85-30), failure of protective coating (IN 85-24), and fouling (IN 81-21, 86-96) has been observed in a number of heat exchangers. Significant wall thinning has been observed on the ID of heat exchanger tubes. Tube heads coated with epoxy have experienced through-wall holes attributed to corrosion. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03. Although the AMP provides an effective means to manage the effects of corrosion on the intended function of heat exchanger, IN 89-13 indicates that deficiencies still exist in implementation of GL 89-13.	
In Response to Generic Letter (GL) 89-13, industry implemented surveillance and control program to manage flow blockage problems in open-cycle service water system due to biofouling, silt, mud, and corrosion products. The program generally includes: (1) Sampling the water annually to determine if the biological species have populated the water source. The system should be chlorinated or treated by biocide when the potential of biological species exists. (2) Monitoring and trending cooling water flow and inlet and outlet temperatures to ensure that flow blockage does not exist. Test frequency ranges from several times per day to once per month. (3) Testing and trending the results of heat removal rate, heat exchange efficiency, or the overall heat transfer coefficient to verify heat removal capabilities. Initial	***(1) Scope of Program:*** The program [illegible] safety-related heat exchangers and their subcomponents. ***(2) Preventive Actions:*** Annual water sampling and treatment with biocide reduces the level of micro-organism activities. ***(3) Parameters Monitored/Inspected:*** The AMP monitors water flow rate and inlet and outlet temperatures which are directly affected by flow blockage. ***(4) Detection of Aging Effects:*** Comparison of flow rate and inlet and outlet temperatures with previous results and acceptance criteria should detect buildup of deposit due to biofouling. ***(5) Monitoring and Trending:*** Effects of biofouling are detectable by monitoring flow rate and heat transfer capabilities, and periodic testing (ranging from several times per day to once per month) provides timely detection of the effects of biofouling. ***(6) Acceptance Criteria:*** Acceptance criteria are based on heat removal rate, heat exchange efficiency, or the overall heat transfer coefficient to verify heat removal capabilities. The acceptance criteria are used to determine whether the heat exchanger performs adequately based on the test results. If the heat exchangers fail to perform adequately, corrective actions are taken. ***(7-9) Corrective Actions,***	No

VIIC1-2

INSERT #12
(SEE CHAPTER
#11 FOR OPEN
CYCLE COOLING WATER
SYSTEM INSPECTIONS
GL-89-13

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.4.1	Flow Orifices	Body	Stainless Steel	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, Micro-biologically-Induced, Pitting, and Crevice Corrosion	Plant Technical Specifications. NRC IN 94-03.
C1.4.1	Flow Orifices	Body	Stainless Steel	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	NRC GL 89-13. NRC IN 94-03.
C1.5.1	Pump	Casing	Cast Steel, Carbon Steel	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, Micro-biologically-Induced, Pitting, and Crevice Corrosion	ASME Section XI, 1989 Edition. ASME OM Code–1990, Subsection ISTB. NRC GL 89-04. Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
(Continued from previous page) test is performed once each fuel cycle and after three tests, the test should be performed at least once every 5 years. (4) If the heat exchangers fail to perform adequately, corrective actions such as cleaning and repair are taken.	*(Continued from previous page)* ~~***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:*** Extensive flow blockage by clams has caused plant shutdown. The heat exchangers have experienced degraded thermal performance due to biofouling. The problems caused frequent cleaning and restrictions of operational flexibility. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.~~	
Same as or the effects of General, Microbiologically-Induced, Pitting, and Crevice Corrosion on Item C1.1.1 piping and fittings.	*Same as for the effects of General, Microbiologically-Induced, Pitting, and Crevice Corrosion on Item C1.1.1 piping and fittings.*	Yes, Element 4 should be further evaluated.
Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.	*Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.*	No
~~The AMP relies on preventive actions by providing corrosion resistant interior linings or coating, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 3 pumps, and additional NRC staff guidelines in 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 technical specifications.~~ VII C1-2	~~**(1)** The AMP relies on corrosion resistant linings and coating and combination of inservice inspection (ISI) and inservice testing (IST) for managing the effects of corrosion on the intended function of the component. ***(2) Preventive Actions:*** Lining and coating prevent corrosion by protecting the underlying metal surfaces from being exposed to corrosive environment. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by ISI to detect system water leakage and IST to evaluate component performance. Requirements of ASME Section XI, Table IWD 2500-1, category D-B, specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic test of all pressure retaining Class 3 components. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 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:** Concentration of sulfates and chlorides in salt water can cause pitting and crevice corrosion under crevice conditions such as gasket surfaces, joints, and under bolt heads. Also, systems that use untreated water~~	[redacted] NO

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR INSERT #12

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE APPLICATION OF GL 89-13.

INSERT #12
(SEE CHAPTER #11 FOR OPEN CYCLE COOLING WATER SYSTEM INSPECTION GL 89-13

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C1.5.1	Pump	Casing	Cast Steel, Carbon Steel	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	NRC GL 89-13. NRC IN 94-03.
C1.6.1	Basket Strainer	Body	Carbon Steel, Stainless Steel	Raw, Untreated Salt Water or Fresh Water	Loss of Material	General, Micro-biologically -Induced, Pitting, and Crevice Corrosion	Plant Technical Specifications. NRC IN 94-03.
C1.6.1	Basket Strainer	Body	Carbon Steel, Stainless Steel	Raw, Untreated Salt Water or Fresh Water	Buildup of Deposit	Biofouling	NRC GL 89-13. NRC IN 94-03.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) are susceptible to microbiologically-induced corrosion. VT-2 examination during system leakage and pressure tests will not detect these forms of corrosion. Therefore, a one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual if the pump is disassembled, and may be covered by the plant maintenance program. UT thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The results of one-time inspection should be used to dictate future inspection. 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 IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** : Corrective actions of the above one time inspection are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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:*** Pitting and crevice corrosion may occur at locations having stagnant flow conditions where impurities in raw and fresh water may concentrate.	
Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.	*Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.*	No
Same as for the effects of General, Microbiologically-Induced, Pitting, and Crevice Corrosion on Item C1.1.1 piping and fittings.	*Same as for the effects of General, Microbiologically-Induced, Pitting, and Crevice Corrosion on Item C1.1.1 piping and fittings.*	Yes, Element 4 should be further evaluated
Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.	*Same as for the effects of Biofouling on Item C1.1.1 piping and fittings.*	No

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIC.1

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VII C1-1	Open Cycle Cooling Water System	C1.1.1. C1.2.1 C1.3.1 Thru C.1.3.5 C.1.4.1 C1.5.1 C1.6.1	Various		GL 89-13 should be used to detect any material degradation or biofouling associated with the open cycle cooling water systems. Reference to ASME Section XI, OM code, GL 89-04, and Tech Specs should be deleted from References, AMP and Evaluation and Technical Basis columns, as applicable. The AMA should only be the "*Open Cycle Cooling Water System Inspections (GL 89-13)*" program. Refer to the proposed program description. Hence, no further evaluation is required.
VII C1-2	Open Cycle Cooling Water System	C1.1.1. C1.2.1 C1.3.1 Thru C.1.3.5 C.1.4.1 C1.5.1 C1.6.1	VII C1-4		Copper alloys and stainless steels are not subject to General Corrosion. Remove these materials from any groupings with carbon steel and create new line item. Aging effect should be loss of material with the related aging mechanisms of pitting corrosion, crevice corrosion, and MIC. The AMA should only be the "*Open Cycle Cooling Water System Inspections (GL 89-13)*" program. Refer to the proposed program description. Hence, further evaluation is not warranted.
VII C1-3	Open Cycle Cooling Water System	C1.1.1	VII C1-6		General corrosion of lined carbon steel is listed as an aging mechanism. Lined carbon steel pipe may be susceptible to localized corrosion in areas of lining degradation but will not be susceptible to gross wastage. This position was accepted in the CCNPP SER.
VII C1-4	Open Cycle Cooling Water System	C1.1.2	VII C1-7		Buried piping will be treated differently at each utility based on the system design as well as management philosophy. Therefore, the existing AMA description should be deleted in its entirety and replaced with requiring a plant specific activity. Hence, further evaluation is warranted.
VII C1-5	Open Cycle Cooling Water System	C1.3.1 Thru C1.3.5	VII C1-14		In the Aging Mechanism column, delete reference to MIC as an aging mechanism related to the Buildup of Deposit aging effect. MIC is already addressed with the Loss of Material aging effect.

C2. Closed Cycle Cooling Water System

C2.1 Piping

C2.1.1 Pipe, Fittings, and Flanges

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

C2.3.1 Body and Bonnet

C2.3 Pump

C2.3.1 Casing

C2.4 Tank

C2.4.1 Shell

C2.5 Flow Orifice

C2.5.1 Body

C2. Closed Cycle Cooling Water System

System, Structures, and Components

The system, structures, and components included in this table comprise the closed cycle cooling water system which consists of piping, valves, radiation element, temperature element, heat exchangers, pumps, tank, and flow orifices. The system contains chemically treated demineralized water. The closed cycle cooling water system is designed to remove heat from various auxiliary systems and components such as chemical and volume control system, spent fuel cooling system, etc. The open cycle cooling water system (Table VII C1) provides the cooling medium for the heat exchangers of the closed cycle cooling water system which serves as an intermediate barrier between the various supplied auxiliary systems and the open cycle cooling water 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 closed cycle cooling water system are classified as Group C Quality Standards.

The AMPs of the heat exchanger between the closed cycle and the open cycle cooling water systems are addressed in the open cycle cooling water system (Table VII C1). The AMPs of the heat exchangers between the closed cycle cooling water system and the interfacing auxiliary systems are included in their respective systems, such as Table VII A.3 for PWR spent fuel cooling water system, Table VII A4 for BWR spent fuel pool cooling and cleanup system, and Table VII E1 for chemical and volume control system.

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

System Interfaces

The systems that interface with the closed cycle cooling water system include the open cycle cooling water system (Table VII C1), PWR spent fuel cooling water system (Table VII A3), BWR spent fuel cooling water system (Table VII A4), chemical and volume control system (Table VII E1), and other miscellaneous auxiliary systems and components.

VII AUXILIARY SYSTEMS

C2. CLOSED CYCLE COOLING WATER SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C2.1.1	Piping	Pipe, Fittings, and Flanges	Carbon Steel (CS)	[redacted] Chemically Treated De-mineralized Water	[redacted] Loss of Material	General, Pitting, and Crevice Corrosion	[redacted] Plant Technical Specifications.

VII C2-3

VII C2-2

VII C2-1

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP relies on minimizing impurities by monitoring and maintaining the chemistry of system water implemented through plant technical specifications and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components. VII C2-1 CLOSED COOLING WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	~~*(1) Scope of Program:* The program relies on monitoring~~ and maintaining the chemistry of the process fluid and ASME Section XI inservice inspection (ISI) to manage the effects of general, pitting, and crevice corrosion on the intended function of the components. ***(2) Preventive Actions:*** The AMP consists of monitoring and controlling the system water chemistry (i.e., the chemically treated demineralized water) to mitigate the corrosion effects and to ensure that no adverse chemistry conditions are present. Monitoring and maintaining the chemistry conditions of the demineralized water will help to ~~mitigate the effects of component degradation by~~ controlling the impurities in the system fluid. ***(3) Parameters Monitored/Inspected:*** The program generally contains chemical parameter specifications, sampling frequency, analysis and corrective actions. The parameters monitored generally include dissolved iron, dissolved copper, chlorides, dissolved oxygen, suspended solids, pH, and hydrazine. They are directly related to potential of corrosion. ASME Section XI, Table IWD 2500-1, examination category D-B requires visual VT-2 examination during system leakage and hydrostatic test. ~~***(4) Detection of Aging Effects:*** Within the closed cycle~~ cooling water system, there are regions of low or stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause crevice and pitting corrosion. VT-2 examination of ASME Section XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, a one-time inspection such as visual examination or UT thickness measurements should be conducted of representative components and susceptible locations to ensure that significant corrosion is not occurring. Based on piping/component geometry, fluid ~~flow conditions, lowest design margin, and time of service~~ susceptible locations can be identified. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The frequency of water chemistry monitoring ranges from several times per week to once a month. The results should provide data for trending. The result of one-time inspection should be used to dictate future inspection. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection period. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides specification of chemical parameters and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with ASME Section XI IWD-3000. ***(7) Corrective Actions:*** Plant chemistry control program specifies the target values for each chemistry parameter in the treated water. If the specified values are exceeded, ~~corrective actions are initiated to bring the chemistry~~ parameters back to normal levels. Corrective actions of the above one-time inspection are based on the results of the inspection. Furthermore, IWA-5250 requires that the source of	Yes, [redacted] SEE CHAPTER 11 FOR THE EVALUATION AND TECHNICAL BASIS FOR THE CLOSED COOLING WATER CHEMISTRY PROGRAM.

VIIC2-3

VIIC2-1

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C2.2.1	Valves (Check, Hand, Control, Relief, and solenoid Valves)	Body and Bonnet	CS	[redacted] Chemically Treated Demineralized Water	Loss of Material	General, Pitting, and Crevice Corrosion	[redacted] Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and IWA-7000 ***(8 & 9) Confirmation Process, and Administrative Controls:*** Site corrective actions program. QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** [redacted] regions of low or stagnant flow conditions that may cause crevice corrosion and pitting at the crevices where impurities and/or corrosive chemicals may concentrate.	
The AMP, implemented by plant technical specifications, relies on minimizing impurities by monitoring and maintaining water chemistry and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B. VII C2-1 CLOSED COOLING WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	[redacted] measures and inservice inspection (ISI) to manage the effects of pitting and crevice corrosion on the component. ***(2) Preventive Actions:*** Chemical parameters such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of corrosion by monitoring and maintaining water chemistry and ISI to detect 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 test of all pressure retaining Class 3 components. ***(4) Detection of Aging*** [redacted] are regions of low or stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause crevice and pitting corrosion. VT-2 examination of ASME Section XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, a one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual if the valve is disassembled, and may be ~~covered by the plant maintenance program.~~ UT thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The frequency of water chemistry monitoring ranges from several times per week to once a month. The results should provide data for trending. The result of one-time inspection should be used to dictate future inspection. System leakage test is conducted prior to plant startup following each refueling ~~outage, and hydrostatic test at or near the end of each~~ inspection period. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides specification of chemical parameters and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with acceptance standards of IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Plant	[redacted] NO SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE CLOSED COOLING WATER CHEMISTRY PROGRAM.

VII AUXILIARY SYSTEMS
C2. CLOSED CYCLE COOLING WATER SYSTEM

VIIC2-3

VIIC2-1

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C2.3.1	Pump	Casing	CS	[redacted] Chemically Treated De-mineralized Water	Loss of Material	General, Pitting, and Crevice Corrosion	[redacted] ISTB. NRC GL 89-04. Plant Technical Specifications.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) chemistry control program specifies the target values for each chemistry parameter in the treated water. If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. Corrective actions of the above one-time inspection are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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.	
The applicable AMP, implemented by the plant technical specifications, relies on minimizing impurities by monitoring and maintaining water chemistry, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B, and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 3 pumps and valves, and additional staff guidelines of NRC Generic Letter 89-04, inservice testing in accordance with ASME Subsection IWP (or Operation and Maintenance Code Subsection ISTB) for pumps, or other approved program in the plant technical specifications. VIIC2-1 CLOSED COOLING WATER CHEMISTRY PROGRAM	***(1) Scope of Program:*** The program relies on monitoring and maintaining water chemistry, inservice inspection (ISI) and inservice testing (IST) to manage the effects of general, pitting, and crevice corrosion on the component. ***(2) Preventive Actions:*** The AMP consists of monitoring and maintaining the system water chemistry to minimize impurities in the system fluid. The program generally contains chemical parameter specifications, sampling frequency, analysis, and corrective actions. Chemical parameters, such as concentrations of chloride, sulfate, oxygen, and impurities are monitored and controlled. ***(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, Table IWD 2500-1, category D-B, specify visual VT-2 (IWA-5240) examination during system leakage and hydrostatic test of all pressure retaining Class 3 components. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 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:*** Within the closed cycle cooling water system, there are regions of low or stagnant flow conditions where impurities and/or corrosive chemicals may concentrate and cause crevice and pitting corrosion. VT-2 examination of ASME Section XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, a one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual if the	~~Yes, Element x should be further evaluated~~ NO

(SEE CHAPTER #11)

SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR CLOSED COOLING WATER CHEMISTRY PROGRAM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C2.4.1	Tank	Shell	C	[redacted] Chemically Treated Demineralized Water	Loss of Material	General, Pitting, and Crevice Corrosion	[redacted] Plant Technical Specification.
C2.5.1	Flow Orifice	Body	SS	[redacted] Chemically Treated Demineralized Water	Loss of Material	General, Pitting, and Crevice Corrosion	[redacted] Plant Technical Specification.

VII C2-3

VII C2-1

VII AUXILIARY SYSTEMS
C2. CLOSED CYCLE COOLING WATER SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) pump is disassembled, and may be covered by the plant maintenance program. UT thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The frequency of water chemistry monitoring ranges from several times per week to once a month. The results should provide data for trending. The result of one-time inspection should be used to dictate future inspection. System leakage test is conducted prior to plant startup following each refueling outage, and hydrostatic test at or near the end of each inspection period. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides specification of chemical parameters and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000 for Class 3 components. ***(7) Corrective Actions:*** Plant chemistry control program specifies the target values for each chemistry parameter in the treated water. If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. Corrective actions of the above one-time inspection are based on the results of the inspection. IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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 flange connections and crevices where buildup of impurities can occur.	
Same as for the effects of General, Pitting, and Crevice Corrosion on Items C2.1.1 pipe, fittings, and flanges.	*Same as for the effects of General, Pitting, and Crevice Corrosion on Items C2.1.1 pipe, fittings, and flanges.*	[redacted]
Same as for the effects of General, Pitting, and Crevice Corrosion on Items C2.1.1 pipe, fittings, and flanges.	*Same as for the effects of General, Pitting, and Crevice Corrosion on Items C2.1.1 pipe, fittings, and flanges.*	[redacted]

VII C2-1

GALL REPORT-MECHANICAL DISCIPLINE
SECTION VIIC.2

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VII C2-1	Closed Cycle Cooling Water System	C2.1.1 C2.2.1 C2.3.1 C2.4.1 C2.5.1	Various		Control of chemistry for treated water environments is sufficient to manage SCC, pitting and crevice corrosion. Reference to ASME Section XI, OM code, GL 89-04, and Tech Specs should be deleted from References, AMP and Evaluation and Technical Basis columns, as applicable. The AMA should only be the "*Closed Cooling Chemistry*" program. Refer to the proposed program description. Hence, no further evaluation is required.
VII C2-2	Closed Cycle Cooling Water System	C2.1.1	VII C2-4		The aging effect should simply refer to the "Loss of Material" in lieu of "Local Loss of Material"
VII C2-3	Closed Cycle Cooling Water System	C2.1.1 C2.2.1 C2.3.1 C2.4.1 C2.5.1	VII C2-4 VII C2-6 VII C2-8 VII C2-10 VII C2-10		Delete reference to 35° C in the Environment column. This temperature adds no value to the identification to aging mechanisms or effects. If not, then translate into Fahrenheit.
VII C2-4	Closed Cycle Cooling Water System	C2.5.1	VII C2-10		Stainless steel is not susceptible to general corrosion. Delete general corrosion in the Aging Mechanism, AMP and Evaluation and Technical Basis columns.

C3. Ultimate Heat Sink

C3.1 Cooling Tower

C3.1.1 Foundation

C3.1.2 Exterior Concrete Above Grade

C3.1.3 Exterior Concrete Below Grade

C3.1.4 Interior Slabs

C3.1.5 Masonry Block Wall

C3.1.6 Concrete Surfaces Exposed to Flowing Water

C3.1.7 Columns

C3.1.8 Base Plates

C3.1.9 Beams

C3.1.10 Trusses

C3.1.11 Bracings

C3.2 Piping

C3.2.1 Piping and Fittings

C3.3 Valves (Check, Hand, and Control Valves)

C3.3.1 Body and Bonnet

C3.4 Pump

C3.4.1 Casing

C3. Ultimate Heat Sink

System, Structures, and Components

The ultimate heat sink consists of a lake, ocean, river, spray pond, or cooling tower and provides sufficient cooling water for safe reactor shutdown and reactor cooldown via the residual heat removal system or other similar system. Due to the varying configurations of connections to lakes, oceans, and rivers, a plant specific aging management program is required. With respect to spray ponds, the spray modules should be covered by the plant maintenance program, and a plant specific aging management program is also required for the spray pond as an entity. Therefore, this table only addresses cooling towers.

The systems, structures and components included in this table consist of piping, valves, pumps, and concrete and steel components such as concrete walls, slabs, foundation, steel beams, columns, and base plates. The cooling tower contains raw or slightly treated fresh water. The ultimate heat sink absorbs heat from the open cycle cooling water system. The cooling tower is classified as Class 1 structures and other components such as piping and valves as Class 3.

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

System Interfaces

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

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.1.1	Cooling Tower	Foundation	Reinforced Concrete	Soft Soil and Ground Water	Cracking, Distortion and Increase in Component Stress Level	Settlement	NUREG-1557. ACI 318-63. ACI 349-85.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Cracking, distortion, and increase in component stress level due to settlement of structure foundations is managed by the structure settlement monitoring program initiated during construction and continued monitoring during operation (NUREG-1557, " Summary of Technical Information and Agreement from Nuclear Management and Resources Council Industry Reports Addressing License Renewal", Oct., 1996). The program consists of measurement of differences on elevations of the structure over a period of time. The structure settlement monitoring program initiated during construction and continued during operation provides identification of any differential settlement and allows appropriate measures to be taken.	***(1) Scope of Program:*** The program is focused on managing the effects of settlement on the intended function of the component. ***(2) Preventive Actions:*** Consideration of differential settlement is required by design codes, such as ACI 318-63 and ACI 349-85. A value of 0.0033 is commonly used as upper design limit for the slope of a settled structure (i.e., the difference in settlement for two points divided by the distance between those two points). Structure settlement monitoring initiated during plant construction provides confirmation that the actual settlement of the structure is consistent with the allowances included in the design basis. The settlement monitoring program continued into operation provides long-term monitoring of settlement (absolute and differential) for sites with soft soil and/or significant changes in ground water. The structure settlement monitoring program initiated during construction and continued during operation should provide identification of any significant (greater than the limit cited above) differential settlement and allows appropriate measures to be taken before there is a loss of the intended function of the structural foundation. ***(3) Parameters Monitored/Inspected:*** The parameter monitored is the settlement (absolute and differential) of foundation over a period of time. ***(4) Detection of Aging Effects:*** Structure settlement monitoring should detect significant differential settlement for sites with soft soil and/or significant ground water changes and allows appropriate measures to be taken before there is a loss of the intended function of the structural foundation. ***(5) Monitoring and Trending:*** The long-term settlement monitoring program provides measurement of settlement and data for trending. ***(6) Acceptance Criteria:*** A value of 0.0033 (NUMARC Report 90-10, "BWR Containments License Renewal Industry Report", Rev. 1, Dec., 1991) is the limit for the slope of a settled structure (i.e., the difference in settlement for two points divided by the distance between those two points). ***(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 applicable for license renewal. ***(10) Operating Experience:*** Cracking, distortion, and increase in stress can be caused by settlement of structural foundations for sites with soft soil and/or significant changes in ground water conditions, such as lowering of the water table. Long-term settlement could exceed plant design limits. Settlements of structural foundation have occurred for sites with soft soil and/or significant changes in ground water conditions, such as lowering of the water table.	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.1.1 thru C3.1.4	Cooling Tower	Foundation, Exterior Concrete Above Grade, Exterior Concrete Below Grade, and Interior Slabs	Reinforced Concrete	Outdoor Ambient Conditions	Scaling, Cracking, and Spalling	Freeze–Thaw	NUREG-1557. ACI 318-63. ACI 349-85.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP should consist of walkdowns and inspections to detect scaling, cracking, and spalling due to freeze-thaw.	***(1) Scope of Program:*** The program relies on the preventive measures by using ACI codes in the design and construction of the components for managing the effects of freeze-thaw on the intended function of the components. For components located in a geographic region of severe or moderate weathering conditions (weather index >100 day–inch/yr), the program relies on the freeze-thaw resistance of the concrete prepared in accordance with ACI 318-63 or ACI 349-85, which requires an appropriate amount of entrained air and water-to-cement ratio for freeze-thaw resistance (NUREG-1557). The weather index is the product of the average annual number of freezing cycle days and the average annual winter rainfall as specified in ASTM C33-82, "Standard Specification for Concrete Aggregates." Freeze–thaw is not significant for concrete structure components located in a geographic region of mild weathering conditions (weather index <100 day–inch/yr) (NUREG-1557). ***(2) Preventive Actions:*** Consideration of freeze-thaw is required by design codes ACI 318-63 and ACI 349-85. Section 4.5, "Special Exposure Requirements," of ACI 349-85 specifies that concrete exposed to freeze-thaw should be adequately air entrained (air content 3.5-6% for moderate exposure and 4.5-7.5% for severe exposure) and has a low water-to-cement ratio (0.45-0.5). Concrete prepared in accordance with ACI 318-63 or ACI 349-85 contains an appropriate amount of entrained air necessary for freeze-thaw resistance, and an amount of cement that both enables the achievement of the desired concrete design strength and a water-to-cement ratio conducive to reduced permeability. ***(3) Parameters Monitored/ Inspected:*** The program relies exclusively on the freeze-thaw resistance provided by ACI codes in design and construction of the components to prevent and mitigate the aging effects due to freeze-thaw. ***(4) Detection of Aging Effects:*** Scaling and spalling could reduce the concrete cover over the reinforcing steel and eventually expose the reinforcing steel to accelerated corrosion. The flat or near flat concrete surfaces are more susceptible to freeze-thaw because of accumulation and saturation. Concrete surfaces at susceptible locations should be inspected to ensure that significant scaling and spalling due to freeze-thaw are not occurring. ***(5) Monitoring and Trending:*** Periodic inspections provide data for trending. ***(6) Acceptance Criteria:*** The concrete mix design should meet the air content (entrained air 3-6%) and water–to–cement ratio (0.45-0.5) requirements of ACI 318-63 or ACI 349-85 for providing the resistance to freeze-thaw. ***(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 applicable for license renewal. ***(10) Operating Experience:*** Scaling, cracking, and spalling on concrete surfaces due to freeze-thaw has occurred for concrete components located in severe weather conditions.	Yes, Element 4 should be further evaluated.

VII AUXILIARY SYSTEMS
C3. ULTIMATE HEAT SINK

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.1.1 thru C3.1.3	Cooling Tower	Foundation, Exterior Concrete Above Grade, and Exterior Concrete Below Grade	Reinforced Concrete	Above Grade: Outdoors Ambient Conditions; Below Grade, and Foundation: Soil and Ground Water	Cracking, Spalling, Loss of Bond, and Loss of Material	Corrosion of Embedded Steel and Rebar	NRC Regulatory Guide 1.127.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP, based on guidelines of NRC Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plant," relies on inspections for all water passages, conduits, sluices, and other concrete surfaces subject to running water for erosion, corrosion, abrasion, cavitation, obstruction, leakage, and cracks at periodic intervals not to exceed 5 years. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation should be performed to assess the deterioration and continuing serviceability and to provide appropriate mitigating measures.	***(1) Scope of Program:*** The program is focused on managing the effects of concrete cracking, spalling, and loss of bond due to corrosion of embedded steel and rebar on the intended function of the components. ***(2) Preventive Actions:*** Regulatory Guide 1.127 recommends inspections of conditions of concrete surfaces, structural cracking, settlement, and water passage at periodic intervals not to exceed 5 years, and compilation of the engineering data. Other recommendations include examination of cooling water channels and canals for channel bank erosion, bed aggravation or degradation and siltation, and examination for any conditions that may impose operational constraints. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation should be performed to assess the deterioration and continuing serviceability and to provide the appropriate mitigating measures. ***(3) Parameters Monitored/Inspected:*** The parameters inspected are the conditions of the concrete surfaces for signs of concrete cracking, spalling, and loss of bond due to corrosion of embedded steel and rebar. ***(4) Detection of Aging Effects:*** Regulatory Guide 1.127 recommends inspection of water-control structures at periodic intervals not to exceed 5 years and includes engineering data compilation, inspection, and evaluation of results. The engineering data compilation consists of collecting and evaluating: (1) general project data (including as-built drawings and construction progress and as-built photographs of concrete surfaces), (2) concrete properties (including the source and type of aggregate, cement used, mix design data, and test results during construction), and (3) pertinent construction records (including construction problems, alteration, modifications, and maintenance repairs). The inspection program includes inspection and evaluation of concrete surfaces, structural cracking, settlement and water passage. Regulatory Guide 1.127 also recommends comparison of previous and present conditions by photographs, and documentation of new or progressive problems and inspection results. When significant changes occur, an evaluation is specified to assess the deterioration and continuing serviceability and to provide appropriate mitigating measures. The periodic inspections outlined in Regulatory Guide 1.127 should detect corrosion of embedded steel and rebar and provide appropriate mitigating measures before there is a loss of the intended function of the components. Because of	Yes, Element 4 should be further evaluated.

VII AUXILIARY SYSTEMS

C3. ULTIMATE HEAT SINK

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C3.1.1 thru C3.1.3	Cooling Tower	Foundation, Exterior Concrete Above Grade, and Exterior Concrete Below Grade	Reinforced Concrete	Above Grade: Outdoors Ambient Conditions; Below Grade, and Foundation: Soil and Ground Water	Increase of Porosity and Permeability, Cracking, and Spalling	Leaching	NUREG-1557. ACI Standard 201.2R-67.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) inaccessibility, the effects of corrosion of embedded steel and rebar on foundation and below grade exterior concrete surfaces should be dealt with on a case-by-case basis (NUREG-1557). ***(5) Monitoring and Trending:*** Periodic inspection of conditions of concrete surfaces at interval not to exceed 5 years and engineering data compilation should provide data for trending. ***(6) Acceptance Criteria:*** No unacceptable visual indication of concrete cracking, spalling, and loss of bond due to corrosion of embedded steel and rebar. ***(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 applicable for license renewal. ***(10) Operating Experience:*** Cracking, spalling, loss of bond, and loss of material caused by corrosion of embedded steel and rebar have occurred, when the component is exposed to aggressive environment (pH <11.5 or chlorides >500 ppm) for a sustained period. Structure components exposed to flowing water with high chlorides have experienced corrosion of rebar. Corrosion related problems have also occurred in concrete cooling tower exposed to flowing water with high sulfate or chloride content.	
The program relies on the preventive measure by using ACI standard ACI 201.2R-67 in design and construction of the component for managing the effects of leaching on the intended function of the component (NUREG-1557). Increase of porosity and permeability due to leaching of calcium hydroxide is non-significant if the components are not exposed to flowing water; or if exposed to flowing water, are constructed using the guidance of ACI 201.2R-67 to ensure dense, well-cured concrete with low permeability and control cracking through proper arrangement and distribution of reinforcement (NUREG-1557).	***(1) Scope of Program:*** The program relies on the preventive measure by using ACI standard 201.2R-67 in design and construction of the component for managing the effects of leaching on the intended function of the component. ***(2) Preventive Actions:*** To cause leaching, the water must be flowing, rather than just filling a crack or voids. Concrete structures prepared in accordance with ACI 201.2R-67 should ensure dense, well-cured concrete and control cracking through proper arrangement and distribution of reinforcement, and an amount of cement that both enables the achievement of the desired concrete design strength and a water-to-cement ratio conducive to reduced permeability necessary for leaching resistance. ***(3) Parameters Monitored/Inspected:*** The program relies exclusively on the leaching resistance provided by ACI standards in design and construction of the concrete component. ***(4) Detection of Aging Effects:*** When concrete is exposed to flowing water such as rain or melting snow, increase of porosity and permeability and loss of strength can occur due to leaching of calcium hydroxide from concrete paste. Cracks and improperly prepared construction joints are potential areas for leaching. Concrete surfaces at susceptible locations should be inspected to ensure that significant cracking and spalling due to leaching are not occurring. ***(5) Monitoring and Trending:*** Periodic inspection provides data for trending. ***(6) Acceptance Criteria:*** ACI 201.2R-67 specifies concrete the air content (entrained air 3-6%) and	Yes, Element 4 should be further evaluated.

VII AUXILIARY SYSTEMS

C3. ULTIMATE HEAT SINK

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.1.1 thru C3.1.3	Cooling Tower	Foundation, Exterior Concrete Above Grade, and Exterior Concrete Below Grade	Reinforced Concrete	Exterior Concrete Above Grade: Outdoors Ambient Conditions Exterior Concrete Below Grade, and Foundation: Soil and Ground Water	Increase of Porosity and Permeabi-lity, Cracking, and Spalling	Aggressive Chemical Attack	NRC Regulatory Guide 1.127

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) water-to-cement ratio (0.45 ~ 0.5) of concrete mixture to ensure dense, well-cured concrete with low permeability and control cracking through proper arrangement and distribution of reinforcement. ***(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 applicable for license renewal. ***(10) Operating Experience:*** Concrete cracking and leaching have been observed in auxiliary building, control building, fuel building, and service water pump room (NUREG-1552).	
The AMP, based on guidelines of NRC Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plant" relies on periodic inspections for all water passages, conduits, sluices, and other concrete surfaces subjects to running water for erosion, corrosion, abrasion, cavitation ,obstruction, leakage, and cracks at periodic intervals not to exceed 5 years. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation is performed to assess the deterioration and continuing serviceability and to provide the appropriate mitigating measures.	***(1) Scope of Program:*** The program is focused on managing the effects of increase of porosity and permeability, cracking and spalling due to aggressive chemical attack on the intended function of the component. ***(2) Preventive Actions:*** Regulatory Guide 1.127 recommends inspections of conditions of concrete surfaces, structural cracking, settlement, and water passage at periodic intervals not to exceed 5 years, and includes engineering data compilation. Other recommendations include examination of cooling water channels and canals for channel bank erosion, bed aggravation or degradation and siltation and examination for any conditions that may impose operational constraints. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation is performed to assess the deterioration and continuing serviceability and to provide the appropriate mitigating measures. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected are the conditions of the concrete surfaces for signs of concrete cracking, spalling, and loss of bond due to aggressive chemical attack. ***(4) Detection of Aging Effects:*** Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plant,"[5] recommends inspection of water-control structures to detect evidence of leakage, cracking, seepage, significant post-construction changes, and deterioration of concrete surfaces and to verify the adequacy and quality of maintenance and operating procedures at periodic intervals not to exceed 5 years. Regulatory Guide 1.127 also recommends comparison of previous and present conditions by photographs, and documentation of new or progressive problems and inspection results. When significant changes occur, an evaluation is recommended to assess the deterioration and continuing serviceability and to provide appropriate mitigating measures. Regulatory Guide 1.127 also recommends engineering data compilation of concrete properties, including the source and type of aggregate, cement used, mix design data, test results and maintenance repairs. Program consistent with Regulatory Guide 1.127 should	Yes, Element 4 should be further evaluated.

VII AUXILIARY SYSTEMS

C3. ULTIMATE HEAT SINK

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.1.5	Cooling Tower	Masonry Block Wall	Masonry	Air	Cracking of Masonry Block Walls	Restrain Shrinkage, Creep, and Aggressive Environ-ment	NRC IEB 80-11. NRC IN 87-67.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) detect cracking and spalling of concrete surfaces caused by aggressive chemical attack and provide appropriate corrective measures before there is a loss of intended functions for the cooling tower. Due to inaccessibility, the effects of aggressive chemical attack on concrete surfaces of foundation and below-grade exterior concrete surfaces should be dealt with on a case-by-case basis (NUREG-1557). ***(5) Monitoring and Trending:*** Periodic inspection of conditions of concrete surfaces at interval not to exceed 5 years and engineering data compilation should provide data for trending. Concrete surfaces of foundation and below-grade exterior concrete surfaces should be dealt with on a case-by-case basis. ***(6) Acceptance Criteria:*** No unacceptable visual indication of concrete cracking and spalling due to aggressive chemical attack. ***(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 applicable for license renewal. ***(10) Operating Experience:*** Structure components exposed to flowing water with high chlorides have experienced corrosion of rebar. Plant using seawater for cooling experienced extensive rebar corrosion and concrete cracking in the onshore intake structure. Corrosion related problems also occurred in concrete cooling tower exposed to flowing water with high sulfate or chloride content.	
The AMP consists of periodic inspection and plant-specific monitoring of cracks of the masonry block walls. The inspection requirements, based on the NRC Information and Enforcement Bulletin (IEB) 80–11, "Masonry Wall Design", include identification of masonry walls in close proximity to, or having attachments from safety-related equipment, and reevaluation of design adequacy and construction practices. The plant-specific monitoring program monitors the growth of existing cracks, the presence of new mortar joint cracks, and to prevent recurrence of cracks at previously repaired joints in accordance with the NRC Information Notice 87-67, "Lessons Learned from Regional Inspections of License Actions in Response to IEB 80-11."	***(1) Scope of Program:*** The program is focused on managing the effects of cracking of masonry block walls on the intended function of the component. ***(2) Preventive Actions:*** NRC Information and Enforcement Bulletin (IEB) 80–11 requests licensees to identify safety-related masonry walls, to repair the existing cracks, to conduct a re-evaluation of the design adequacy and construction practices, and to establish a mitigation program. Information Notice (87-67) 87–67 further recommends licensees to establish plant-specific program for monitoring cracks of masonry walls, to analyze the probably cause of the cracks, to evaluate structural adequacy of the walls, to document the repair effort, and to provide countermeasures for preventing recurrence of similar cracks. ***(3) Parameters Monitored/Inspected:*** IEB 80–11 and Information Notice (IN) 87–67 which monitor existing cracks and provide countermeasures for preventing recurrence of similar cracks. Program incorporating of IEB 80–11 and Information Notice 87–67 throughout the license renewal period is acceptable for maintaining the intended functions of the structure components with respect to cracking of masonry walls due to restraint, shrinkage, creep, and aggressive environment.	No

VII AUXILIARY SYSTEMS

C3. ULTIMATE HEAT SINK

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.1.6	Cooling Tower	Concrete Surfaces Exposed to Flowing Water	Reinforced Concrete	Raw, Untreated Fresh Water	Loss of Material	Abrasion and Cavitation	NRC Regulatory Guide 1.127

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(4) Detection of Aging Effects:*** IEB 80-11 requests licensees to identify safety-related masonry walls in close proximity to or have attachments from safety-related attachments or equipment. IN 87-67 recommends licensees to monitor cracks of masonry walls, to analyze the probably cause of the cracks, to evaluate structural adequacy of the walls, and to provide countermeasures for preventing recurrence of similar cracks. If the provisions of IEB 80-11 and the plant-specific monitoring program as suggested in the IN 87-67 are in practice throughout the license renewal period, cracking of masonry walls should be detected before there is a loss of the component intended function. ***(5) Monitoring and Trending:*** Periodic monitor and inspection provide data for trending. ***(6) Acceptance Criteria:*** No unacceptable cracking of masonry block walls due to restrain shrinkage, creep, and aggressive environment as determined by engineering analysis. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be applicable for license renewal. ***(10) Operating Experience:*** Cracking of masonry block walls have occurred from restraint, shrinkage, creep, and aggressive environment. Masonry block wall cracks could be active during the period of extended operation. Growth of existing cracks has been observed and documented in some plants.	
The AMP consists of periodic inspections in accordance with Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plant" which recommends that all water passages, conduits, sluices, and other concrete surfaces subjects to running water should be examined for erosion, corrosion, abrasion, cavitation, obstruction, leakage, and cracks at periodic intervals not to exceed 5 years. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation is performed to assess the deterioration and continuing serviceability and to provide the appropriate mitigating measures.	***(1) Scope of Program:*** The program is focused on managing the effects of abrasion and cavitation on the intended function of the component. ***(2) Preventive Actions:*** Regulatory Guide 1.127 recommends inspections of conditions of concrete surfaces, structural cracking, settlement, and water passage at periodic intervals not to exceed 5 years, and includes engineering data compilation. Other recommendations include examination of cooling water channels and canals for channel bank erosion, bed aggravation or degradation and siltation and examination for any conditions that may impose operational constraints. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation is performed to assess the deterioration and continuing serviceability and to provide the appropriate mitigating measures. Corrective actions are based on the results of the above inspections. ***(3) Parameters Monitored/Inspected:*** The parameters inspected are the conditions of the concrete surfaces for signs of degradation due to abrasion and cavitation. ***(4) Detection of Aging Effects:*** Regulatory Guide 1.127 recommends all concrete surfaces of spray pond and cooling tower subject to running water should be examined for abrasion and cavitation at	No

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C3.1.7 thru C3.1.11	Cooling Tower	Columns, Base Plates, Beams, Trusses, Bracings	Structural Steel (Painted or Galvanized)	Outdoors Ambient Conditions	Loss of Material	Corrosion	NRC Regulatory Guide 1.127

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) periodic intervals not to exceed 5 years. Aging management program consistent with Regulatory Guide 1.127 should detects degradation of concrete surfaces due to abrasion and cavitation and provides mitigating measures before there is a loss of component intended function. ***(5) Monitoring and Trending:*** Periodic inspection of conditions of concrete surfaces at interval not to exceed 5 years and engineering data compilation should provide data for trending. ***(6) Acceptance Criteria:*** No unacceptable visual indication of loss of concrete material due to abrasion and cavitation. ***(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 applicable for license renewal. ***(10) Operating Experience:*** Loss of material of concrete surfaces that are continuously exposed to flowing water have occurred by abrasion and cavitation.	
The AMP, based on Regulatory Guide 1.127, relies on periodic inspection of all structural steel components of water-control structures such as cooling tower for corrosion at periodic intervals not to exceed 5 years. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation is performed to assess the deterioration and continuing serviceability and to provide the appropriate mitigating measures.	***(1) Scope of Program:*** The program is focused on managing the effects of structural steel corrosion on the intended function of the component. ***(2) Preventive Actions:*** Regulatory Guide 1.127 recommends detailed inspection of water-control structures at periodic intervals not exceed 5 years for any significant deterioration caused by corrosion of structural steel, including cracking, discoloration, wear, pitting, excessive corrosion, surfaces discontinuities, and coating degradation and take preventive measures. Other recommendations include examination of cooling water channels and canals for channel bank erosion, bed aggravation or degradation and siltation and examination for any conditions that may impose operational constraints. When significant degradation is found, Regulatory Guide 1.127 recommends that an evaluation is performed to assess the deterioration and continuing serviceability and to provide the appropriate mitigating measures. Corrective actions are based on the results of the above inspections. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected are the conditions of the structural steel surfaces (columns, base plates, beam, trusses, and bracings, etc.) for any signs of degradation due to corrosion, such as cracking, discoloration, wear, pitting, excessive corrosion, surfaces discontinuities, and coating degradation. ***(4) Detection of Aging Effects:*** Regulatory Guide 1.127 recommends all structural steel surfaces (columns, base plates, beam, trusses, and bracings, etc.) of spray pond and cooling tower should be examined for signs of corrosion at periodic intervals not to exceed 5 years. Aging management program consistent with Regulatory Guide 1.127 should detects degradation of structural steel surfaces due to corrosion, and	No

VII C3-1

VII C3-2

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
C3.2.1	Piping	Piping and Fittings (With or Without Internal Lining or Coating)	Brass, Copper-Nickel, CS	Raw Untreated Fresh Water	Loss of Material	General, Micro-biologically-Induced, Pitting, and Crevice Corrosion. Selective Leaching (for brass material).	[redacted]

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) provides mitigating measures before there is a loss of component intended function. ***(5) Monitoring and Trending:*** Periodic inspection of conditions of structural steel surfaces at interval not to exceed 5 years and engineering data compilation should provide data for trending. ***(6) Acceptance Criteria:*** No unacceptable visual inspection of loss of material of structural steel components due to corrosion. ***(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 applicable for license renewal. ***(10) Operating Experience:*** Structural steel corrosion has occurred in the water-control structures.	
The AMP relies on preventive actions by selecting corrosion resistant materials, designing with corrosion allowance or providing corrosion resistant interior lining or coating, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components.	***(1) Scope of Program:*** The AMP relies on selecting corrosion resistant materials, corrosion allowance or corrosion resistant lining or coating, and ASME Section XI inservice inspection (ISI) for managing the effects of corrosion and selective leaching on intended function of the component. ***(2) Preventive Actions:*** The component is constructed of corrosion resistant materials such as red brass and copper-nickel. Lining or coating prevent corrosion and selective leaching by protecting the underlying metal surfaces from being exposed to corrosive environment, and unprotected piping, e.g., carbon steel used in fresh water systems, are designed with a corrosion allowance. ***(3) Parameters Monitored/Inspected:*** ASME Section XI, Table IWD 2500-1, Category D-B requires visual VT-2 examination during system leakage and hydrostatic test to detect leakage. Degradation due to pitting and crevice corrosion of the component can not occur without leakage of raw or fresh water, extent and inspection schedule assure detection of leakage before the loss of intended function of the component. ***(4) Detection of Aging Effects:*** Concentration of sulfates and chlorides in water can cause localized corrosion under crevice conditions such as gasket surfaces, joints, and under bolt heads. Also, systems that use untreated water are particularly susceptible to microbiologically-induced corrosion. System leakage and pressure tests may not be adequate to detect these forms of corrosion; inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified. ***(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	Yes, ~~Elements should be further evaluated~~.

PLANT SPECIFIC PER VII C3-1

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.3.1	Check, Hand, & Control Valves	Body and Bonnet (With or Without Internal Lining or Coating	Bronze, SS	Raw Untreated Fresh Water	Loss of Material	General, Micro-biologically -Induced, Pitting, and Crevice Corrosion. Selective Leaching (for bronze material)	ASME Section XI, 1989 Edition. Plant Technical Specifications. VII C3-1

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(Continued from previous page)~~ 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 IWD-3000. ***(7) Corrective Actions:*** IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and IWA-7000. ~~***(8 & 9) Confirmation Process and Administrative***~~ ***Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be applicable for license renewal. ***(10) Operating Experience:*** Pitting and crevice corrosion may occur at locations having stagnant flow conditions, where impurities in raw and fresh water may concentrate. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.	2
The AMP relies on preventive actions by selecting corrosion resistant materials, designing with corrosion allowance or providing corrosion resistant interior lining or coating, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B.	***(1) Scope of Program:*** The AMP relies on selecting corrosion resistant materials, corrosion allowance or corrosion resistant lining or coating, and inservice inspection (ISI) for managing the effects of corrosion and selective leaching on intended function of the valves. ***(2) Preventive Actions:*** The component is constructed of corrosion resistant material such as red brass and copper nickel for preventing the occurrence of corrosion. Carbon steel components are provided with corrosion allowance or corrosion resistant lining or coating. ***(3) Parameters Monitored/Inspected:*** Examination category D-B of ASME Section XI Table IWD 2500-1 requires VT-2 examination during system leakage test and system hydrostatic test to detect the leakage. Degradation due to pitting and crevice corrosion of the component can not occur without leakage of raw or fresh water, extent and inspection schedule assure detection of leakage before the loss of intended function of the component. ***(4) Detection of Aging Effects:*** Concentration of sulfates and chlorides can cause localized corrosion under crevice conditions such as gasket surfaces, joints, and under bolt heads. Also, systems that use untreated water are particularly susceptible to microbiologically-induced corrosion. System leakage and pressure tests may not be adequate to detect these forms of corrosion; inspection of representative valves and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual if the valve is disassembled, and may be covered by the plant maintenance program. UT thickness measurements could also be used. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI PLANT SPECIFIC VII C3-1	Yes, [redacted]

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
C3.4.1	Pump	Casing (with or without internal lining or coating)	Cast steel, Carbon steel	Raw Untreated Fresh Water	Loss of Material	General, Micro-biologically-Induced, Pitting, and Crevice Corrosion.	~~ASME Section XI, 1989 Edition. ASME OM Code–1990, Subsection ISTB. NRC GL 89-04. Plant Technical Specifications.~~ VII C3-3

VII AUXILIARY SYSTEMS
C3 ULTIMATE HEAT SINK

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] ~~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 IWD-3000. ***(7) Corrective Actions:*** IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and IWA-7000. ***(8 & 9) Confirmation Process and Administrative Controls:*** Site corrective actions program,~~ [redacted] administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be applicable for license renewal. ***(10) Operating Experience:*** Localized corrosion may occur at locations having stagnant flow conditions, where impurities may concentrate. The NRC performed service water system operational performance inspection and the results have been discussed in NRC Information Notice (IN) 94-03.	
The AMP relies on preventive actions by providing corrosion resistant interior linings or coating, and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 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.	[redacted] ***Program:*** The AMP relies on corrosion resistant linings and coating and combination of both inservice inspection (ISI) and inservice testing (IST) for managing the effects of corrosion on intended function of the pump. ***(2) Preventive Actions:*** Lining and coating prevent corrosion by protecting the underlying metal surfaces from being exposed to corrosive environment. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by ISI to detect leakage and IST to evaluate pump performance. 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. Based on the requirements of 10 CFR 50.55a for ASME Code Class 1, 2, and 3 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 system water or degradation of component performance; extent and schedule of ISI/IST assure detection of corrosion before the loss of intended function of the component. However, inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual if the pump is disassembled, and may be covered by the plant maintenance program. UT thickness measurements could also be used. ***(5) Monitoring and Trending:*** ISI/IST schedule of ASME Section XI should provide for timely detection of corrosion. System leakage test is conducted prior	Yes, [redacted]

PLANT SPECIFIC PER VII C3

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) 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 IWD-3000 for Class 3 components. ***(7) Corrective Actions: :*** IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with IWA-4000 and 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 applicable for the period of license renewal. ***(10) Operating Experience:*** Pitting and crevice corrosion may occur in portion of the system, such as locations having stagnant flow conditions where impurities in raw and fresh water may concentrate.	

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIC.3

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VII C3-1	Ultimate Heat Sink	C3.2.1 C3.3.1	VII C3-20 VII C3-21 VII C3-22 VII C3-23		Brass, copper nickel alloys and stainless steels are not subject to general corrosion. Remove these materials from any groupings with carbon steel and create new line item, where applicable and/or delete reference to general corrosion when these materials are identified independent of carbon steel. Aging effect should be loss of material with the related aging mechanisms of pitting corrosion, crevice corrosion, MIC and selective leaching (for bronze material). Reference to ASME Section XI, OM code, GL 89-04, and Tech Specs should be deleted from References and AMP columns. The Evaluation and Technical Basis column should be deleted in its entirety based on unique plant features and management philosophy. The AMA will be a plant specific activity requiring further NRC evaluation.
VII C3-2	Ultimate Heat Sink	C3.2.1 C3.3.1 C3.4.1	VII C3-20 VII C3-22 VII C3-24		General corrosion of lined carbon steel is listed as an aging mechanism. Lined carbon steel pipe may be susceptible to localized corrosion in areas of lining degradation but will not be susceptible to gross wastage. This position was accepted in the CCNPP SER.
VII C3-3	Ultimate Heat Sink	C3.4.1	VII C3-24 VII C3-25		Reference to ASME Section XI, OM code, GL 89-04, and Tech Specs should be deleted from References and AMP columns. The Evaluation and Technical Basis column should be deleted in its entirety. The AMA will be a plant specific activity requiring further NRC evaluation.

D. Compressed Air System

D.1 Piping

D.1.1 Piping and Fittings

D.2 Air Accumulator

D.2.1 Shell

D.2.2 Manway

D.2.3 Manway Bolting

D.3 Valves

D.3.1 Body and Bonnet

D.4 Filter

D.4.1 Shell

D.4.2 Manway

D.4.3 Manway Bolting

D. Compressed Air system

System, Structures, and Components

The system, structures, and components included in this table comprise the compressed air system which consists of piping, valves, air accumulators and filters. The components normally contain very dry air, free of oil, water, and other contaminants. The system components and piping are located in various buildings at most nuclear power plants. 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 compressed air system are classified as Group C Quality Standards.

Valves are considered to be active components and seats, discs, bolting, and other valve items should be covered by the plant maintenance program.

System Interfaces

No other systems contained in this report interface with the compressed air system.

VII AUXILIARY SYSTEMS
D. COMPRESSED AIR SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D.1.1	Piping	Piping and Fittings	Carbon Steel (CS) and Alloy Steel	Internal: Dry, Oil-Free Air: Occasionally Exposure to Moist Air. ~~External: Room Air~~ VII D-1	Loss of Material	General and Pitting Corrosion	~~NRC IN 81-38. NRC IN 87-28. NRC IN 87-28 S1. NRC GL 88-14. INPO SOER 88-01. ASME OM Guide Part 17.~~ VII D-1
D.2.1 thru D.2.3	Air Accumulator	Shell, Manway, Manway Bolting	CS	Internal: Dry, ~~Oil-free Air~~ Occasionally Exposure to Moist Air. External: Room Air	Loss of Material	General and Pitting Corrosion	~~NRC IN 81-38. NRC IN 87-28. NRC IN 87-28 S1. NRC GL 88-14. INPO SOER 88-01. ASME OM Guide Part 17.~~
D.3.1	Valves	Body and Bonnet	CS	Internal: Dry, ~~Oil-free Air~~. Occasionally Exposure to Moist Air. External: Room Air	Loss of Material	General and Pitting Corrosion	~~NRC IN 81-38. NRC IN 87-28. NRC IN 87-28 S1. NRC GL 88-14. INPO SOER 88-01. ASME OM Guide Part 17.~~

VII D-2

VII D-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The aging management program (AMP), based on NRC Generic Letter (GL) 88-14 and INPO's Significant Operating Experience Report (SOER) 88-01, relies on improved system inspections, maintenance, and testing, and generally includes: (1) frequent leak testing of valves, piping, and other system components, especially those made of carbon steel, and (2) preventive maintenance program which checks air quality at several locations in the system to address various aspects of the inoperability of air-operated components due to the presence of oil, water, rust, and other contaminants. Corrective actions are taken if any parameters are out of acceptable ranges, such as moisture content in the system air. The ASME Operation and Maintenance (OM) Guide Part 17, Performance Testing of Instrument Air System in Light-Water Reactor Power Plants, February 12, 1999 could be used as guidance for testing of air systems. PLANT SPECIFIC PER VII D-2	***1) Scope of Program:*** The program relies on improved system inspection and maintenance program to manage the effects of corrosion on the intended function of the compressed air system. ***(2) Preventive Actions:*** The system air quality is monitored and maintained in accordance with manufacturer recommendations for individual components served. ***(3) Parameter Monitored/ Inspected:*** Based on the guidelines of NRC Generic Letter (GL) 88-14 perform in-service testing to verify proper air quality, and that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the air system is maintained. ***(4) Detection of Aging Effects:*** Degradation of the piping would become evident by observation of unacceptable leakage rates. However, inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. Based on piping or component geometry and flow conditions, susceptible locations can be identified. ***(5) Monitoring and Trending:*** Effects of corrosion are detectable by periodic local leak rate tests that also provide for timely detection of aging effects based on operating experience. ***(6) Acceptance Criteria*** The testing results are used to verify that the design and performance of the entire air system is in accordance with its intended function. ***(7-9) 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:*** Potentially significant problems pertaining to air systems have been documented in NRC Information Notices (INs) 87-28 and 87-28 S1. Some of the systems that have been significantly degraded or have failed include decay heat removal, auxiliary feedwater, main steam isolation, containment isolation, and fuel pool seal system.	Yes, ~~Element 4 should be further evaluated.~~
Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings.	*Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings.*	Yes, [redacted]
Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings.	*Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings.* PLANT SPECIFIC PER VII D-2	Yes, [redacted]

VII D-1 VII D-1

VII AUXILIARY SYSTEMS

D. COMPRESSED AIR SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
D.4.1 thru D.4.3	Filter	Shell, Manway, Manway Bolting	CS	Internal: [redacted] Occasionally Exposure to Moist Air. External: Room Air	Loss of Material	General and Pitting Corrosion	NRC IN 81-38. NRC IN 87-28. NRC IN 87-28 S1. NRC GL 88-14. INPO SOER 88-01. ASME OM Guide Part 17.

VII AUXILIARY SYSTEMS

D. COMPRESSED AIR SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings.	*Same as the effects of General and Pitting Corrosion on Item D.1.1 piping and fittings.*	Yes, [redacted]

PLANT-SPECIFIC PER VII D-1

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VII D

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT/ RESOLUTION
VII.D-1	Auxiliary Systems - Compressed Air System	D.1.1, D.2.1 Thru D.2.3, D.3.1, D.4.1 Thru D.4.3	VII D-4 VII D-5 VII D-6 VII D-7		The environment column identifies the external environment as room air. External environments have not been provided in the majority of the GALL report. Thus, recommend deleting any reference to external environments until a common approach is developed for the remaining plant systems and components.
VII.D-2	Auxiliary Systems - Compressed Air System	D.1.1, D.2.1 Thru D.2.3, D.3.1, D.4.1 Thru D.4.3	VII D-4 VII D-5 VII D-6 VII D-7		The compressed air system expected to be in-scope for license renewal is the Instrument Air (IA) system and the portion the plant service air system that penetrates the containment structure. The IA system design usually has the component order of compressor, accumulator, and dryer. The accumulator receives air from the air compressor, which is normally the portion of the system exposed to "saturated" air. Equipment located downstream of the dryers are exposed to "dry" and "oil free" air and as such are not susceptible to age related degradation. Thus, delete "Dry, Oil-Free Air" from Environment" column. This section should only address equipment that is exposed to "saturated air" as discussed above. The AMA to manage the aging effect of loss of material as the result of general and pitting corrosion should be plant specific based on the differences in system design and management philosophy. Delete the existing AMP and Evaluation and Technical Basis columns in their entirety and replace with the "*Plant-specific aging management activity is to be evaluated.*" Hence, further evaluation is warranted (no AMA).

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

E1.1 Piping (1500 psig rating)

E1.1.1 Pipe, Fittings and Flanges

E1.1.2 Stud and Nuts

E1.2 Piping (150 psig rating)

E1.2.1 Pipe, Fittings and Flanges

E1.2.2 Studs and Nuts

E1.3 High-Pressure Valve

E1.3.1 Body and Bonnet

E1.3.2 Studs and Nuts

E1.4 Low-Pressure Valve

E1.4.1 Body and Bonnet

E1.4.2 Studs and Nuts

E1.5 High-Pressure Pump

E1.5.1 Casing

E1.5.2 Closure Bolting

E1.6 Low-Pressure Pump

E1.6.1 Casing

E1.6.2 Closure Bolting

E1.7 Letdown Heat Exchanger

E1.7.1 Tube/Tubesheet

E1.7.2 Studs and Nuts

E1.7.3 Channel/Cover

E1.7.4 Channel/Welds

E1.7.5 Shell

E1.8 Regenerator Heat Exchanger

E1.8.1 Tube/Tubesheet

E1.8.2 Studs and Nuts

E1.8.3 Channel/Cover

E1.8.4 Channel/Welds

E1.8.5 Shell

E1.9 Basket Strainers

E1.9.1 Studs and Nuts

E1.10 Tank

E1.10.1 Studs and Nuts

E1.10.2 Shell

E1.10.3 Manway

E1.10.4 Penetrations/Nozzles

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

System, Structures, and Components

The system, structures, and components included in this table comprise the pressurized water reactor (PWR) chemical and volume control system and consist of piping, valves, heat exchangers, pumps, basket strainers, and tank. The majority of the components contain chemically treated borated water, except the heat exchangers which contain chemically treated demineralized water. 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 chemical and volume control system are classified as Group C Quality Standards.

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

System Interfaces

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

VII AUXILIARY SYSTEMS

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.1.1 E1.1.2	High Pressure Piping (1500 psig rating)	Pipe, Fittings, and Flanges, Studs and Nuts	Pipe, Fittings, and Flanges: Stainless Steel (SS) Studs and Nuts: Low-Alloy Steel (LAS), Carbon Steel (CS)	Chemically Treated Borated Water up to 340°C.	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
E1.1.2	High Pressure Piping (1500 psig rating)	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.

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-limit 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. DELETE/REWRITE PER VII E1-2	Yes TLAA
In response to NRC Generic Letter (GL) 88-05 to manage loss of material due to general corrosion, pitting and crevice corrosion on carbon steel and low alloy steel components as a result of borated water leaks, the AMP generally includes: (1) Identify the examination locations where borated water leaks could occur, including insulated components and inaccessible areas. The focus is on small leaks which generally occur below technical specification limits for operational leakage. (2) Establish the path of the leaking borated water and the components it likely to contact to ensure that leaks of borated water are promptly identified and corrected. (3) Perform visual inspection at least once at each refueling outage to identify and quantify any leakage at specific locations and to remove any borated water residue that is found. Visual examination, such as VT-2 visual examination is generally used for evidence of leaks such as discoloration and borated water residue. (4) Investigate any leakage that is found and locate leak source and areas of corrosion. Evaluate the affected components for continued service by engineering analysis. Corrective actions include repair or replacement of the affected components and correction of any equipment deficiencies that cause the leaks.	~~***(1) Scope of Program:*** The program focuses on managing loss of material due to borated water corrosion on the carbon steel and low alloy steel components. The focus is on small leaks which generally occur below technical specification limits for operational leakage.~~ ***(2) Preventive Actions:*** Periodic inspection and removal of any borated water residue from component surface during system walkdown help to prevent the occurrence of borated water corrosion. Identification of the potential locations of leakage and the path of leaking acid also helps to prevent the occurrence of the borated water leak. ~~***(3) Parameters Monitored/Inspected:*** The AMP performs visual inspection for discoloration of insulation and borated water residue which are signs of borated water leakage. Visual inspection, such as VT-2, is an effective method for identification of discoloration and borated water residue. One or more studs are removed and examined for evidence of boric acid corrosion. ***(4) Detection of Aging Effects:*** The AMP establishes the path of the leaking borated water and the components it likely to contact to ensure that leaks of borated water are promptly identified and corrected before there is a loss of the component intended function.~~ ***(5) Monitoring and Trending:*** ~~The visual inspection is an effective method for~~ detecting the signs of boric water leaks. Periodic inspection provides data for trending. ***(6) Acceptance Criteria:*** No discoloration or borated water residue found on surfaces of components, insulation, or floor areas that may indicate borated water leakage. No leakage of non-insulated and insulated components. No leakage of accessible and inaccessible components. ***(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. Corrective actions include repair or replacement of the affected components and correction of any equipment deficiencies that cause the leaks. ***(10) Operating Experience:*** Leakage of borated water from bolted joints or seals has frequently caused severe corrosion of carbon steel and low alloy steel components such as bolts, studs, and fasteners.	No SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR BORIC ACID CORROSION PROGRAM

VII E1-3 BORIC ACID CORROSION PROGRAM (SEE CHAPTER #11)

VII AUXILIARY SYSTEMS
E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E1.2.1 E1.2.2	Low Pressure Piping (150 psig rating)	Pipe, Fittings, and Flanges Stud and Nuts	Pipe, Fittings, and Flanges: SS Studs and Nuts: LAS, CS	Chemically Treated Borated Water up to 100°C.	Cumulative Fatigue Damage	Fatigue	ANSI B31.1. DELETE PER VII E1-4, VII E1-5
E1.2.2	Low Pressure Piping (150 psig rating)	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1.2.1	Low Pressure Piping (150 psig rating)	Pipe, Fittings, and Flanges	SS	Chemically Treated Borated Water up to 100°C.	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	~~IN 84-18.~~ ~~Plant Technical Specifications.~~ EPRI TR-105714

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-limit aging analysis (TLAA) to be performed for the period of license renewal, check Code limit for allowable cycles (less than 7000 cycles) of thermal stress range. DELETE	Yes TLAA
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No
The AMP, implemented by plant technical specifications, relies on minimizing impurities by monitoring and maintaining the borated water chemistry conditions. Because the diameter of piping is generally less than 4 inches, inservice inspection (ISI) of ASME Section XI Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components is usually exempted. VII E1-6 PRIMARY WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	~~**(1) Scope of Program:** The program relies on monitoring~~ and maintaining the chemistry conditions of the borated water for managing the effects of pitting corrosion and crevice corrosion on the intended function of the component. ***(2) Preventive Actions:*** The program contains chemical parameter specifications, sampling frequency, analysis and corrective actions. Monitoring and maintaining the borated water chemistry conditions will help to minimize the rate and effects of component degradation. The preventive actions, however, are considered inadequate because of inadvertent introduction of impurities into the system due to ~~unacceptable levels of contaminants in the borated water~~ (IN 84-18). Pitting corrosion and crevice corrosion may occur at locations having stagnant flow conditions where impurities in borated water fluid may concentrate over the years. ***(3) Parameters Monitored/ Inspected:*** Chemical parameters such as impurities are monitored and controlled. ***(4) Detection of Aging Effects:*** High concentration of impurities at locations having stagnant flow could cause pitting and crevice corrosion under crevice conditions such as gasket surfaces, and joints. Because the diameter of piping is generally less than 4 inches, inservice inspection (ISI) of ASME Section ~~XI is usually exempted. Therefore, an one time inspection~~ of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** Sampling of chemistry condition performs periodically. The data provides trending. The results of the one time inspection should be used to dictate the future inspection. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides chemical parameter ~~specification and acceptable levels. **(7) Corrective Actions:**~~ Plant chemistry control program specifies the target values for chemistry parameter in the borated water. If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. Corrective actions	~~Yes, Element 4 should be further evaluated~~ NO SEE CHAPTER 11 FOR THE EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM

VII AUXILIARY SYSTEMS
E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
1.2.1	Low Pressure Piping (150 psig rating)	Pipe, Fittings, and Flanges	SS	Exterior Surfaces: Adhered with Electrical Heat Tracing Maintaining up to 100°C. Interior Surfaces: Chemically Treated Borated Water up to 100°C	Crack Initiation and Growth	Stress Corrosion Cracking	NRC IN 85-34. Plant Technical Specifications.

DELETE PER VII E1-6 VII E1-7 VII E1-8

VII AUXILIARY SYSTEMS

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page) of the above one time inspection are based on the results of the inspection. ***(8 & 9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Significant corrosion-related problems have not been reported for the component.~~	
The electrical heating tracing is usually adhered on the component exterior surfaces to maintain the borated water at 71°C above the saturation temperature. The high temperature due to the heat tracing and the halogens used in the adhesive material can cause externally-initiated stress corrosion cracking in the stainless steel components of the CVCS heat-traced piping. The AMP manages the aging effects by removing the corrosive adhesive and choosing another method (containing no halogens) to adhere the heat tracing. In addition, the AMP, implemented by plant technical specifications, relies on minimizing impurities by monitoring and maintaining the borated water chemistry conditions.	***(1) Scope of Program:*** The program manages the effects of crack initiation and growth due to stress corrosion cracking on the intended function of the stainless steel components subjected to high temperature and corrosive chemicals present in the heat tracing. ***(2) Preventive Actions:*** Monitoring and maintaining the chemistry conditions of borated water will help to minimize the rate and effects of component degradation by minimizing the impurities in the system fluid. ***(3) Parameters Monitored/Inspected:*** The chemistry of the system fluid is monitored and controlled to mitigate the effects of SCC on the intended function of the component. ***(4) Detection of Aging Effects:*** Removal of the corrosive adhesive of the heat tracing will prevent future stress corrosion cracking. The stress corrosion cracking, however, might already exist in components due to heat tracing. Inspection of the external surface of the component should be performed to ensure that the heating tracing has not caused any significant SCC degradation. The acceptance criteria and the basis should also be included in the AMP. ***(5) Monitoring and Trending:*** The borated water is sampled frequently. The data provides trending. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides chemical parameter specification and acceptable levels. The AMP should include acceptance criteria and the basis for inspection of SCC due to heat tracing. ***(7) Corrective Actions:*** Plant chemistry control program specifies the target values for each chemistry parameter in the borated water If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. ***(8 & 9) Confirmation Process, and Administrative Controls:*** QA procedures, site review and approval process, and administrative controls should be implemented in accordance with Appendix B to 10 CFR Part 50 requirements to be adequate for license renewal. ***(10) Operating Experience:*** Externally-initiated stress corrosion cracking has occurred in the heat-traced CVCS borated water recirculation line due to the presence of high temperature and chlorides in the adhesive of the heat tracing. The NRC Information Notice (IN) 85-34 indicated that stress corrosion cracking failure of stainless DELETE PER VII E1-6 VII E1-7	[redacted] NO

VII AUXILIARY SYSTEMS
E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.3.1 E1.3.2	High Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Body and Bonnet, Studs and Nuts	Body and Bonnet: SS Studs and Nuts: CS, LAS	Chemically Treated Borated Water up to 340°C.	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
E1.4.1 E1.4.2	Low Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Body and Bonnet, Studs and Nuts	Body and Bonnet: SS Studs and Nuts: CS, LAS	Chemically Treated Borated Water up to 100°C.	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E1.3.1	High Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Body and Bonnet	SS	Chemically Treated Borated Water up to 340°C.	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	IN 84-18. Plant Technical Specifications.

DELETE PER VII E1-4

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page) steel piping pertaining to the use of heat tracing is a potentially significant problem. Seven through-wall cracks have been observed in a stainless steel piping at regions where the pipes sagged. The cracks are caused by the combination of the chlorides concentration and the heat application from the heat tracing.~~	
Components have been designed for fatigue for a 40 y design life according to the requirements of ANSI B31.1.	Fatigue is a time-limit 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
Same as for Fatigue of Item E1.3.1 and E1.2.2, Body and Bonnet, Studs and Nuts.	*Same as for Fatigue of Item E1.3.1 and E1.2.2, Body and Bonnet, Studs and Nuts.*	Yes TLAA
The AMP, implemented by plant technical specifications, relies on minimizing impurities by monitoring and maintaining the borated water chemistry conditions. Because the diameter of piping is generally less than 4 inches, inservice inspection (ISI) of ASME Section XI Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components is usually exempted.	***(1) Scope of Program:*** The program relies on monitoring and maintaining the chemistry conditions of the borated water for managing the effects of pitting corrosion and crevice corrosion on the intended function of the component. ***(2) Preventive Actions:*** The program contains chemical parameter specifications, sampling frequency, analysis and corrective actions. Monitoring and maintaining the borated water chemistry conditions will help to minimize the rate and effects of component degradation. The preventive actions, however, are considered inadequate because of inadvertent introduction of impurities into the system due to unacceptable levels of contaminants in the borated water (IN 84-18). Pitting corrosion and crevice corrosion may occur at locations having stagnant flow conditions where impurities in borated water fluid may concentrate over the years. ***(3) Parameters Monitored/Inspected:*** Chemical parameters, such as impurities are monitored and controlled. ***(4) Detection of Aging Effects:*** High concentration of impurities at locations having stagnant flow could cause pitting and crevice corrosion under crevice conditions such as gasket surfaces, and joints. Therefore, an one-time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. This inspection can be visual if the valve is disassembled and may be covered by the	Yes, Element 4 should be further evaluated

VII AUXILIARY SYSTEMS

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.4.1	Low Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Body and Bonnet	SS	Chemically Treated Borated Water up to 100°C	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	IN 84-18. Plant Technical Specifications.
E1.3.2	High Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1.4.2	Low Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.

DELETE PER VII E1-6 VII E1-7 VII E1-8

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) plant maintenance program. Ultrasonic thickness measurements could also used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** Sampling of chemistry condition performs periodically. The data provides trending. The results of the one time inspection should be used to dictate the future inspection.***(6) Acceptance Criteria:***: The chemistry monitoring program provides chemical parameter specification and acceptable levels. ***(7) Corrective Actions:*** Plant chemistry control program specifies the target values for chemistry parameter in the borated water. If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. Corrective actions of the above one time inspection are based on the results of the inspection. ***(8 & 9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Significant corrosion-related problems have not been reported for the component.	
Same as for Pitting Corrosion and Crevice Corrosion of Item E1.3.1 Body and Bonnet.	*Same as for Pitting Corrosion and Crevice Corrosion of Item E1.3.1 Body and Bonnet.* - DELETE -	Yes, Element 4 should be further evaluated
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.4.1	Low Pressure Valves (Check, Control, Hand, Motor Operated, Pressure Control, and Relief Valves)	Body and Bonnet	SS	Exterior Surfaces: Adhered to Electrical Heat Tracing Maintaining up to 100°C. Interior Surfaces: Chemically Treated Borated Water up to 100°C.	Crack Initiation and Growth	Stress Corrosion Cracking	NRC IN 85-34.
E1.5.1 E1.5.2	High Pressure Pump	Casing, Closure Bolting	Casing: SS, Closure Bolting: CS, LAS	Chemically Treated Borated Water up to 340°C	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
E1.6.1 E1.6.2	Low Pressure Pump	Casing, Closure Bolting	Casing: SS, Closure Bolting: CS, LAS	Chemically Treated Borated Water up to 100°C.	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E1.5.2	High Pressure Pump	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1.6.2	Low Pressure Pump	Closure Bolting	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1.5.1	High Pressure Pump	Casing	SS	Chemically Treated Borated Water up to 340°C.	Local Loss of Material	Pitting Corrosion 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. Plant Technical Specifications.

DELETE PER VII E1-6 VII E1-7 VII E1-8 VII E1-9

DELETE PER VII E1-4

VII E1-11

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for Stress Corrosion Cracking of Item E1.2.1 Pipe, Fittings, and Flanges. DELETE PER VII E1-6 VII E1-7 VII E1-8	*Same as for Stress Corrosion Cracking of Item E1.2.1 Pipe, Fittings, and Flanges.* VII E1-9	Yes, Element 4 should be further evaluated
Components have been designed for fatigue for a 40 y design life according to the requirements of ANSI B31.1.	Fatigue is a time-limit 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 [illegible] DELETE PER VII E1-4	Yes TLAA
Same as for Fatigue of Items E1.5.1 and E1.5.2 Casing and Closure Bolting.	*Same as for Fatigue of Items E1.5.1 and E1.5.2 Casing and Closure Bolting.*	Yes TLAA
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No
The applicable AMP, based on guidelines given in EPRI TR 102134, is implemented by the plant technical specifications and relies on minimizing impurities by monitoring and maintaining water chemistry conditions. Inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B, and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 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	***(1) Scope of Program:*** The program relies on preventive measures and inservice testing (IST) ~~to manage the effects~~ of pitting and crevice corrosion on the ~~components.~~ ***(2) Preventive Actions:*** Monitoring and maintaining the borated water chemistry helps to minimize the rate and effects of component degradation by minimizing the impurities in the borated water. The preventive actions, however, are considered inadequate because of inadvertent introduction of impurities into the system due to unacceptable levels of contaminants in the borated water (IN 84-18). ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of corrosion by control of water chemistry and by ISI to detect leakage and IST to evaluate component performance. Inspection requirement of ASME Section XI specify visual VT-2 examinations during system leakage and hydrostatic tests of all pressure retaining	~~Yes, Element 4 should be further evaluated.~~ NO

SEE PAGE #17

VII AUXILIARY SYSTEMS

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.6.1	Low Pressure Pump	Casing	SS	Chemically Treated Borated Water up to 100°C.	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	~~[redacted] Section XI, 1989 Edition.~~ ~~ASME OM Code-1990, Subsection~~ [redacted] NRC GL 89-04 NRC IN 84-18. NRC IN 96-11. Plant Technical Specifications.

VII E1-6

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
(continued from previous page) ISTB) for pumps, or other approved program in the plant specifications. VII E1-11 PRIMARY WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	~~*(continued from previous page)*~~ Class 3 components. 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:*** High concentration of impurities at locations having stagnant flow could cause pitting and crevice corrosion under crevice conditions such as gasket surfaces, and joints. VT-2 examination required by ASME Section XI, Table IWD 2500-1 will not detect pitting and crevice corrosion. Therefore, an one time ~~inspection of representative components and susceptible~~ locations should be undertaken to ensure that significant corrosion is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** Sampling of chemistry condition performs periodically. The data provides trending. The results of the one time inspection should be used to dictate future inspection. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides chemical ~~parameter specification and acceptable levels.~~ ***~~(7)~~ Corrective Actions:*** Plant chemistry control program specifies the target values for chemistry parameter in the borated water. If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. Corrective actions of the above one time inspection are based on the results of the inspection. ***(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. The potential exists for introduction of impurities into the system as contaminants in the borated water (IN 84-18).	SEE CHAPTER 11 FOR THE EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM
Same as for Stress Corrosion Cracking of Item E1.2.1 Pipe, Fittings, and Flanges.	*Same as for Stress Corrosion Cracking of Item E1.2.1 Pipe, Fittings, and Flanges.*	Yes, Element 4 should be further evaluated

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.7.1 thru E1.7.4	Letdown Heat Exchanger	Tube/Tube Sheet, Studs and Nuts, Channel/ Cover, Channel/ Welds	SS, CS	Tube Side: Chemically Treated Borated Water up to 340°C; Shell Side: Chemically Treated De-mineralized Water	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
E1.8.1 thru E1.8.4	Regeneration Heat Exchanger	Tube/Tube Sheet, Studs and Nuts, Channel/ Cover, Channel/ Welds	SS, CS	Tube and Shell Side: Chemically Treated Borated Water up to 340°C.	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
E1.7.2	Letdown Heat Exchanger	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1.8.2	Regeneration Heat Exchanger	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1.7.5	Letdown Heat Exchanger	Shell	SS	Shell Side: Chemically Treated De-mineralized Water Tube Side: Chemically Treated Borated Water up to 340°C.	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	Plant Technical Specifications.

VII AUXILIARY SYSTEMS

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized 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-limit 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
Components have been designed for fatigue for a 40 y design life according to the requirements of ANSI B31.1.	Fatigue is a time-limit 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
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No
Crevice corrosion and pitting can occur at the crevices that are not exposed to the general flowstream or under stagnant flow conditions, such as at the tubesheet-shell joint, and other crevices in the shell side of heat exchanger exposed to the chemically treated demineralized water. The AMP, implemented by plant technical specifications, relies on minimizing impurities by monitoring and maintaining the demineralized water chemistry conditions. Because the diameter of piping is generally less than 4 inches, inservice inspection (ISI) of ASME Section XI Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components is usually exempted. PRIMARY WATER CHEMISTRY PROGRAM	~~**(1) Scope of Program:** The program relies on monitoring and maintaining the chemistry conditions of the demineralized water for managing the effects of pitting corrosion and crevice corrosion on the intended function of the component. ***(2) Preventive Actions:*** The program contains chemical parameter specifications, sampling frequency, analysis and corrective actions. Monitoring and maintaining the demineralized water chemistry conditions will help to minimize the rate and effects of component degradation. The AMP, however, is inadequate to manage the effects of pitting corrosion and crevice corrosion which may occur at locations not exposed to the general flowstream or under stagnant flow conditions, such as at the tubesheet-shell joint, where impurities may concentrate over the years. ***(3) Parameters Monitored/Inspected:*** Chemical parameters, such as impurities are monitored and controlled. ***(4) Detection of Aging Effects:*** High concentration of impurities at locations having stagnant flow could cause pitting and crevice corrosion under crevice conditions. Therefore, an one-time inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. This inspection can be visual if the heat exchanger is~~	~~Yes [illegible]~~ NO

(SEE CHAPTER #11)

SEE CHAPTER XI [illegible] EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM.

VII AUXILIARY SYSTEMS

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E1.8.5	Regeneration Heat Exchanger	Shell	SS	Shell and Tube Side: Chemically Treated Borated Water	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	Plant Technical Specifications.
E1.9.1	Basket Strainer	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1. 10.1	Tank	Studs and Nuts	LAS, CS	Air, Leaking Chemically Treated Borated Water	Loss of Material	Boric Acid Corrosion	NRC GL 88-05.
E1. 10.2 thru E1. 10.4	Tank	Shell, Manway, Penetration/ Nozzles	SS	Chemically Treated Borated Water up to 340°C.	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	IN 84-18. Plant Technical Specifications.

VII AUXILIARY SYSTEMS

E1. CHEMICAL AND VOLUME CONTROL SYSTEM (Pressurized Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ disassembled and may be covered by the plant maintenance program. Ultrasonic thickness measurements could also be used. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** Sampling of chemistry condition performs periodically. The data provides trending. The results of the above one time inspection should be used to dictate the future inspection. ***(6) Acceptance Criteria:***: The chemistry monitoring program provides chemical parameter specification and acceptable levels. ***(7) Corrective Actions:*** Plant chemistry control program specifies the target values for chemistry parameter in the demineralized water. If the specified ~~values are exceeded, corrective actions are initiated to~~ bring the chemistry parameters back to normal levels. Corrective actions of the above one time inspection are based on the results of the inspection. ***(8 & 9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience :*** Crevice corrosion and pitting can occur at the crevices that are not exposed to the general flowstream or under stagnant flow conditions, ~~such as at the tubesheet shell joint, and other crevices in~~ the shell side of heat exchanger exposed to the chemically treated demineralized water.	
Same as for Pitting Corrosion and Crevice Corrosion of Item E1.7.5 Shell.	*Same as for Pitting Corrosion and Crevice Corrosion of Item E1.7.5 Shell.*	Yes, Elements 4 should be further evaluated
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.*	No
Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts.	*Same as for Boric Acid Corrosion of Item E1.1.2 Studs and Nuts*	No
Same as for Pitting Corrosion and Crevice Corrosion of Item E1.3.1 Body and Bonnet.	*Same as for Pitting Corrosion and Crevice Corrosion of Item E1.3.1 Body and Bonnet.*	Yes, Element 4 should be further evaluated

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.1

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VII E1-1	Chemical and Volume Control System	E1.1.1 Through E1.8.4	VII E1-4 through 7, 10, 11, 14, 15, 18 and 19		The system design may preclude Fatigue as an aging mechanism. System and components designed to exceed the requirements of ASME or ANSI for Fatigue should not have this Aging Mechanism and require no further review. (Other comments in this section may apply to Fatigue when it is not precluded by design)
VII E1-2	Chemical and Volume Control System (PWR)	E1.1.1 and E1.1.2	VII E1-4 and 5		Fatigue is listed as an Aging Mechanism for High Pressure Components. The **'Existing AMP'** entry states that components have been designed for fatigue for a 40 year design life in accordance with ANSI 31.1. This is simply not a true statement for several reasons. The portions of the CVCS that are subject to Fatigue are those portions that are connected to the RCS. This part of the system was designed in accordance with ANSI B31.7. In any event, there is no aspect of ANSI 31.1 that considers design life in years. If a stress range reduction factor of 1.0 is used in the design analysis, it will have been assumed that the components in question will experience less than 7,000 thermal cycles. There is no explicit correlation to a time period in this evaluation. Also, simply identifying Fatigue as a TLAA does not identify an AMP per se. No information is provided, for example, relevant to Fatigue Monitoring Programs that calculate Cumulative Usage Factors based on partial cycles. This entry provides no useful information to prospective applicants and in fact contains misleading and incorrect statements.
VII E1-3	Chemical and Volume Control System (PWR)	E1.1.2	VII E1-5		For the BAC entry, the **'Evaluation and Technical Basis'** element (3) indicates that "One or more studs are removed and examined for evidence of boric acid corrosion". This seems overly prescriptive and may only be necessary in extreme cases. Change "are" to "may be". Replace program with AMA titled *'Boric Acid Corrosion Program'* in lieu of the existing listed program.

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.1

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VII E1-4	Chemical and Volume Control System	E1.2.1, 1.2.2, 1.4.1, 1.4.2, 1.5.1 and 1.5.2	VII E1-6, 7, 10, 11, 14 and 15		Fatigue is listed as an Aging Mechanism for the CVCS Low Pressure Piping, Low Pressure Valves and Bolting and High Pressure Pump. These components are not subjected to high temperatures or thermal cycles that could cause Fatigue; this Aging Mechanism should not be listed for these items. This position was accepted in the CCNPP SER.
VII E1-5	Chemical and Volume Control System (PWR)	E1.2.1 and E1.2.2	VII E1-6 and 7		Fatigue is listed as an Aging Mechanism for Low Pressure Components. The comment above for High Pressure Components relating to the time-related design life in the statement in the **'Existing AMP'** entry applies here also. Also, CCNPP made the argument that Class 2 and 3 piping Fatigue was not a TLAA based on a similar argument: There is no aspect of ANSI 31.1 that considers design life in years. If a stress range reduction factor of 1.0 is used in the design analysis, it will have been assumed that the components in question will experience less than 7,000 thermal cycles. There is no explicit correlation to a time period in this evaluation, so the TLAA criterion of applying to the 40-year service life cannot be met. The NRC considered the evaluation performed by BGE to demonstrate that Fatigue was not Plausible for Class 2 and 3 piping constituted the TLAA evaluation under 54.21(c)(1)(i).
VII E1-6	Chemical and Volume Control System	E1.2.1, 1.3.1, 1.4.1, 1.5.1, 1.6.1, 1.7.5, 1.8.5, 1.10.2, 1.10.3 and 1.10.4	VII E1-6 through 21		**'Evaluation and Technical Basis'** for corrosion of Stainless Steel should credit only the chemistry control program in Borated water systems with well controlled chemistry parameters. This would justify a 'no' in the Further Evaluation section. 'One time inspections' should not be required. Refer to AMA titled *'Chemistry Program (Primary)'* in lieu of the existing listed program.
VII E1-7	Chemical and Volume Control System	E1.2.1	VII E1-8 Through 11		Low Pressure Piping Stress Corrosion Cracking identifies the Environment as External with Heat Tracing and internal with treated water. The Region of Interest is identified as Low Pressure Piping up to 100°C. The use of adhesives with halogens would appear to be a 'Degradation induced by human activities' (Generic Licensing Renewal Issue # 98-0013) and not a real Aging concern. There should not be any action in the Further Evaluation column.

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.1

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
					More correctly this item should be deleted as design and material controls consistent with Reg. Guide 1.43 preclude cracking.
VII E1-8	Chemical and Volume Control System (PWR)	E1.2.1 and E1.4.1	VII E1-8, 9, 14 and 15		SCC is listed as an Aging Mechanism for Low Pressure Components. (This item has been previously commented on. If the this Aging Mechanism is not deleted them this comment applies.) The instance of SCC at CCNPP from which this entry derives was a plant-specific, one time only event. It is not apparent how this **'AMP'** (the replacement of the heat trace cement) will provide any useful information to other prospective applicants. In addition, the plant chemistry program should not be listed as an AMP in this case because the condition of the process fluid has no bearing on the conditions required for external SCC. Leaking process fluid provided the aqueous environment necessary for initiation of SCC, and the level of any impurities in the CVCS fluid was not a contributing factor.
VII E1-9	Chemical and Volume Control System	E1.4.1	VII E1-14 and 15		Low Pressure Valves Stress Corrosion Cracking identifies the Environment as External with Heat Tracing and internal with treated water. The Region of Interest is identified as Low Pressure Valves up to 100°C. The use of adhesives with halogens would appear to be a 'Degradation induced by human activities' (Generic Licensing Renewal Issue # 98-0013) and not a real Aging concern. There should not be any action in the Further Evaluation column. More correctly this item should be deleted as design and material controls consistent with Reg. Guide 1.43 preclude cracking.

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VII E1-10	Chemical and Volume Control System	E1.5.1, E1.5.2 E1.6.1 and E1.6.2	VII E1-14, 15, 16 and 17		The **'Environment'** for High Pressure Pump list temperatures up to 340°C. The **'Environment'** for Low Pressure Pump is listed to 100°C. The High Pressure Pumps are not subjected to high temperatures during normal operations or even during Post-accident conditions. The Low Pressure Pumps do see higher temperatures but not above 200°C. Revise these two **'Environment'** entries to match their application.
VII E1-11	Chemical and Volume Control System (PWR)	E1.5.1	VII E1-14, 15 and 17		Crevice Corrosion/Pitting is listed as an Aging Mechanism for the High Pressure Pump. ISI/IST is listed as an **'Existing AMP'** but the **'Evaluation and Technical Basis'** section appears to indicate that ISI/IST (in the guise of VT-2 exams) is not adequate to discover Crevice Corrosion/Pitting. A one-time inspection is indicated instead, which in essence makes this entry the same as all the other Crevice Corrosion/Pitting entries in this section. Since ISI/IST is not actually to be credited, it should not be listed. Additionally the **'AMP'** column lists the Secondary Chemistry program 102134 instead of the Primary program 105714. Refer to AMA titled *'Chemistry Program (Primary)'* in lieu of the existing listed program.

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

E2. Standby Liquid Control System (Boiling Water Reactor)

E2.1 Piping

E2.2 Solution Storage Tank

E2.3 Solution Storage Tank Heaters

E2.4 Pump Suction Valves

E2.5 Injection Pumps

E2.6 Relief Valves

E2.7 Injection Valves

E2.8 Containment Isolation Valves

E2.9 Injection Sparger

E2.10 Pump Suction Valves

E2. Standby Liquid Control System (Boiling Water Reactor)

System, Structures, and Components

The system, structures, and components included in this table comprise the standby liquid control system, which serves as a backup reactivity control system in all boiling water reactors (BWRs) in the U.S. The major components of this system are the piping, solution storage tank, solution storage tank heaters, pump suction valves, injection pumps, relief valves, injection valves, containment isolation valves, injection sparger, and pump suction valves. All of these components operate in contact with a Na pentaborate solution and are fabricated of austenitic stainless steel. Based on U.S. Nuclear Regulatory Commission Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," all components in the standby liquid control system are classified as Group B Quality Standards.

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

System Interfaces

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

VII AUXILIARY SYSTEMS

E2. STANDBY LIQUID CONTROL SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E2.1	Piping	ID surfaces	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈5000 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001, Plant Technical Specifications
E2.2	Solution Storage Tank	ID surfaces	Stainless Steel	Sodium pentaborate solution at 70-150°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
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. Water chemistry controls in accordance with Plant Technical Specifications. VII E2-1 PRIMARY WATER CHEMISTRY PROGRAM & INSERVICE INSPECTION PROGRAM (SEE CHAPTER #11)	***(1) Scope of Program:*** The program includes preventive 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 requirements of Regulatory Guide (RG) 1.44 prevent or mitigate SCC. Also, control of halogens, oxygen, and other impurities in the water in accordance with Plant Technical Specifications to mitigate the potential for SCC. ***(3) Parameters Monitored/Inspected:*** The parameters monitored are concentrations of impurities in the water to reduce the potential for stress corrosion cracking at the weld heat-affected zones. Periodic surface and volumetric inspections are required for Class 2 piping welds. 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 the piping due to SCC can not occur without crack initiation. ASME Section XI inspection requires examination of only the welds and weld regions, and the potential of cracking of susceptible SS components and cladding remote from welds is not addressed. However, no cracking associated with Na pentaborate solutions, either at or away from welds, has been reported in nuclear plants (NUREG/CR-6001). ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWC-2400 should provides timely detection of cracks. ***(6) Acceptance Criteria:*** Any IGSCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-4000 and IWC-3[illegible]33, 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 occurrences of stress corrosion cracking in piping and other components in standby liquid control systems have ever been reported (NUREG/CR-6001). Cracking has been seen infrequently in fuel storage pool systems in contact with boric acid solutions, and the primary cause has been unacceptable levels of contaminants in the boric acid. However, these solutions are not directly comparable to Na pentaborate solutions because of the higher pH (near neutral) and highly buffered characteristics of the latter.	No SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM AND INSERVICE INSPECTION PROGRAM.
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No

VII AUXILIARY SYSTEMS

E2. STANDBY LIQUID CONTROL SYSTEM (Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E2.3	Solution Storage Tank Heaters	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001
E2.4	Pump Suction Valves	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001
E2.5	Injection Pumps	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001
E2.6	Relief Valves	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001
E2.7	Injection Valves	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001
E2.8	Containment Isolation Valves	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001
E2.9	Injection Sparger	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001
E2.10	Pump Suction Valves	Surfaces in contact with Na pentaborate solution	Stainless Steel	Sodium pentaborate solution at 70-90°C (≈1100 ppm B)	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NUREG/CR-6001

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No
Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.	*Same as effects of Stress Corrosion Cracking of Internal Surfaces on Item E2.1: Piping.*	No

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.2

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VII E2-1	SBLC (BWR)	E2.1 Thru E2.10	VII E2-4 Thru VII E2-7		The concentrations of sodium pentaborate will vary in different BWRs. ***Element 2 - Preventive Actions:*** Every plant may not have Tech Specs to monitor impurities in the "water". What is the "water"?

E3. Reactor Water Cleanup System

E3.1 Piping

E3.1.1 Pipe and Fittings (beyond isolation valves)

E3.2 Recirculation Pump

E3.2.1 Bowl/Casing

E3.2.2 Cover

E3.2.3 Seal Flange

E3.2.4 Closure Bolting

E3.3 Valves (Quality Group A)

E3.3.1 Body

E3.3.2 Bonnet

E3.3.3 Seal Flange

E3.3.4 Closure Bolting

E3.4 Regenerative Heat Exchanger

E3.4.1 Tubing

E3.4.2 Shell

E3.5 Non-Regenerative Heat Exchanger

E3.5.1 Tubing

E3.5.2 Shell

E3.6 Filter/Demineralizer

E3.6.1 Internals

E3. Reactor Water Cleanup System

System, Structures, and Components

The system, structures, and components included in this table comprise the reactor water cleanup system, which provides for cleanup and particulate removal from the recirculating cooling water in all boiling water reactors (BWRs) in the US. Portion of the reactor water cleanup system, extending from the coolant recirculation system up to the second isolation valve outside the containment, forms the primary pressure boundary, and is classified as Group A Quality Standards. The remainder of the system can be isolated from the reactor and is subject to much less stringent design and inspection requirements for the balance of plant. The aging management program for isolation valves in the reactor water cleanup system is reviewed in Table V C.

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

System Interfaces

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

SEE
VII E-3

VII AUXILIARY SYSTEMS

E3. REACTOR WATER CLEANUP SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E3.1.1	Piping	Piping and Fittings (beyond second isolation valve)	SS, Types 304, 316, or 316NG	Oxygenated Water up to 288°C	Crack Initiation and Growth	SCC, IGSCC	~~NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S.~~ Plant Technical Specifications
E3.1.1	Piping	Piping and Fittings (beyond second isolation valve)	SS, Types 304, 316, or 316NG	Oxygenated Water up to 288°C	Cumulative Fatigue Damage	Fatigue	ANSI B31.1.
E3.2.1, E3.2.2	Reactor Water Cleanup Pump	Bowl/Casing, Cover	Cast Austenitic Stainless Steel (CASS) SA351 CF-8 or CF-8M	Oxygenated Water up to 288°C	Loss of Fracture Toughness	Thermal Embrittle-ment	-

DELETE PER VII E3-5

VII AUXILIARY SYSTEMS
E3. REACTOR WATER CLEANUP SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
For piping ≥4-in. or greater in diameter and operating at temperature >200°F, the program delineated in NUREG-0313, Rev. 2 and implemented through NRC Generic letter (GL) 88-01 and its Supplement 1 is applicable. Other piping as well as inspection requirements for all piping is governed by Plant Technical Specifications. VII E3-3 VII E3-4 PLANT SPECIFIC AMA FOR E3.1.1	***(1) Scope of Program:*** The program is focused on managing the effects of IGSCC on the intended function of austenitic stainless steel (SS) piping 4 in. or larger in diameter, and reactor vessel attachments and appurtenances: NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. However, smaller diameter piping is exempt. ***(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 (SI). Furthermore, hydrogen water chemistry and stringent control of conductivity is used to inhibit IGSCC. ***(3) Parameters Monitored/ Inspected:*** Governed by plant-specific aging management program. ***(4) Detection of Aging Effects:*** Governed by plant-specific aging management program. ***(5) Monitoring and Trending:*** Governed by plant-specific aging management program. ***(6) Acceptance Criteria:*** Governed by plant-specific aging management program. ***(7) Corrective Actions:*** Governed by plant-specific aging management program.. ***(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 or nickel alloys. The comprehensive AMP outlined in NUREG-0313 and GL 88-01 is based on substantial effort in research and development, and industry recommendations developed in response to NRC communications. The program addresses improvements in the three elements that cause IGSCC, e.g., a susceptible (sensitized) material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring structural integrity of austenitic stainless steel piping.	Yes. Elements 3 through 7 should be further evaluated MOVE TO CHAPTER #10
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 13
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated. VII E3-5	Yes no AMP

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E3.2.1, E3.2.2	Reactor Water Cleanup Pump	Bowl/Casing, Cover	CASS	Oxygenated Water up to 288°C	Crack Initiation and Growth	SCC, IGSCC	NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S 1.
E3.2.1 thru E3.2.3	Reactor Water Cleanup Pump DELETE	Bowl/Casing, Cover, Seal Flange	CASS, SS VII	E3-5 Oxygenated Water up to 288°C	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. GSI-190.
E3.2.4	Reactor Water Cleanup Pump DELETE	Closure Bolting	High Strength Low-Alloy Steel (HSLAS); Stainless Steel	Air, Leaking Oxygenated Water VII VII	Attrition E3-5 E3-6	Wear	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. NRC Bull 89-02. NRC IN 90-68 S1. ASME Section XI. 1989 Edition.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Guidelines of NUREG-0313, Rev. 2 and NRC Generic letter (GL) 88-01 and its Supplement 1. Inspection requirements are governed by plant-specific aging management programs.	***(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 intended function of the pump. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of cast SSs and weld metal, with a maximum carbon of 0.035% and minimum 7.5% ferrite. Also, hydrogen water chemistry and stringent control of conductivity is used to inhibit IGSCC. However, high-carbon grades of cast SS, e.g., CF-8 and CF-8M may be susceptible to SCC. ***(3) Parameters Monitored/Inspected:*** Governed by plant-specific aging management program. ***(4) Detection of Aging Effects:*** Governed by plant-specific aging management program. ***(5) Monitoring and Trending:*** Governed by plant-specific aging management program. ***(6) Acceptance Criteria:*** Governed by plant-specific aging management program. ***(7) Corrective Actions:*** Governed by plant-specific aging management program. ***(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 NUREG-0313 and GL 88-01 is based on substantial effort in research and development, and industry recommendations developed in response to NRC communications. The program addresses improvements in all elements that cause IGSCC, e.g., susceptible (sensitized) material, significant tensile stress, and an aggressive environment, and has provided effective means of assessing structural integrity of austenitic stainless steel components.	Yes, Elements 3 through 7 should be further evaluated
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a) or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. DELETE	Yes TLAA
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; and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a),	***(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 DELETE	No

VII AUXILIARY SYSTEMS

E3. REACTOR WATER CLEANUP SYSTEM

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) Subsection IWB, Table IWB 2500-1, examination categories B-G-1 or B-G-2 for pressure retaining bolting, and testing category B-P for system leakage.	*(continued from previous page)* 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. The use of A 286 SS for pump internal bolting is not recommended if torqued to a stress in excess of 100 ksi (IN 90-68 S1). Also, hardness of internal preload Type [illegible] SS and 17-4 PH bolting is limited to Rockwell [illegible] (Bull 89-02). ***(3) Parameter Monitored/Inspected:*** The AMP monitors the effects of aging degradation on the intended function of closure bolting by detection of coolant leakage, and by detection [illegible] of cracks by inservice inspection (ISI). Inspection requirements of ASME Section XI, Table IWB 2500-1, examination category B-G-1 for bolting greater than 2 in. in diameter specify volumetric examination of studs and bolts from top of the nut to bottom of the flange hole, and visual VT-1 examination of surfaces of nuts, washers, bushings, and flanges including 1 in. annular surface of flange surrounding each stud. Examination category B-G-2 for bolting 2 in. or smaller specifies only visual VT-1 examination of surfaces of bolts, studs, and nuts. 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 are limited to components selected for inspection under examination category B-M-2, B-L-2, or B-J, and may be performed in place under tension, when connection is disassembled, or when bolting is removed. 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. Inspection requirements of ASME Section XI testing category B-P specify visual VT-2 (IWA-5240) examination of all pressure retaining components extending to and including the second closed valve at the boundary extremity, during system leakage test (IWB-5221) and system hydrostatic test (IWB-5222). ***(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. Inspection schedule in accordance with IWB-2400 requires inspection of all bolts, studs, nuts, bushing, and flange surfaces every 10 y. System leakage test is conducted prior to plant	

DELETE PER VII E3-5 VII E3-6

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E3.2.4	Recirculation Pump	Closure Bolting	HSLAS	Air, Leaking Oxygenated Water	Loss of Preload	Stress Relaxation	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02.
E3.2.4	Recirculation Pump	Closure Bolting	HSLAS	Air, Leaking Oxygenated Water	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E3.3.1	Valves (Quality Group D)	Valve Body	CASS	Oxygenated Water up to 288°C	Loss of Fracture Toughness	Thermal Embrittle-ment	-
E3.3.1, E3.3.2	Valves (Quality Group D)	Valve Body, Bonnet	CASS, SS	Oxygenated Water up to 288°C	Crack Initiation and Growth	SCC, IGSCC	NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S1.
E3.3.1 thru E3.3.3	Valves (Quality Group D)	Valve Body, Bonnet, Seal Flange	CS, CASS, SS	Oxygenated Water up to 288°C	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. GSI-190.

VII E3-5
VII E3-6

NOT IN SCOPE PER
VII E3-7

VII AUXILIARY SYSTEMS
E3. REACTOR WATER CLEANUP SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ 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 IWB-3100 by comparing ISI results with the acceptance standards of IWB-3400 and IWB-3515 and 3517. Any relevant conditions that may be detected during the leakage and hydrostatic tests are compared with the acceptance standards of IWB-3522. ***(7) Corrective Actions:*** Repair and replacement is in conformance with IWB-4000 and 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:*** Significant number of incidents have been reported on bolts and nuts that have failed or become degraded because of boric acid wastage or SCC in PWRs. However, for both BWRs and PWRs, 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 the effect of wear on Item E3.2: Closure Bolting for Recirculation Pump.	*Same as the effect of wear on Item E3.2: Closure Bolting for Recirculation Pump.* VII E3-5	No
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NB, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed. VII E3-6	Yes TLAA
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes no AMP
Same as the effect of crack initiation and growth on Item E3.2: bowl, casing, and cover for recirculation pump.	*Same as the effect of crack initiation and growth on Item D3.2: bowl, casing, and cover for reactor water cleanup pump.* VII E3-7	Yes. Elements 3 through 7 should be further evaluated
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a) or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed.	Yes TLAA

VII AUXILIARY SYSTEMS

E3. REACTOR WATER CLEANUP SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E3.3.4	Valves (Quality Group D)	Closure Bolting	HSLAS	Air, Leaking Oxygenated Water	Loss of Preload	Stress Relaxation	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. NRC Bull 89-02. NRC IN 90-68 S1. ASME Section XI, 1989 Edition.
E3.3.4	Valves (Quality Group D)	Closure Bolting	HSLAS	Air, Leaking Oxygenated Water	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E3.4.1	Regenerative Heat Exchanger	Tubing	SS	Oxygenated water at 288°C and 10 MPa max.	Crack Initiation and Growth	SCC, IGSCC	NRC GL 8-01. NRC GL 88-01, S1.
E3.4.1	Regenerative Heat Exchanger	Tubing	SS	Oxygenated water at 288°C and 10 MPa max.	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E3.4.2	Regenerative Heat Exchanger	Shell	HSLAS with SS Cladding	Oxygenated water at 288°C and 10 MPa max.	Crack Initiation and Growth	SCC, IGSCC	NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S1. NRC IN 90-29.

NOT IN SCOPE

VII E3-8

VII E3-8

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as the effect of stress relaxation on Item E3.2 Closure Bolting for Recirculation Pump.	*Same as the effect of wear on Item C1.2.4 Closure Bolting for Recirculation Pump.*	No
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NB, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed.	Yes TLAA
Same as the effect of stress corrosion cracking on Item E3.1: Piping and Fittings beyond second Isolation Valve.	*Same as the effect of stress corrosion cracking on Item E3.1: Piping and Fittings beyond second Isolation Valve.*	Yes. Elements 3 through 7 should be further evaluated
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NB, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed.	Yes TLAA
Materials selection in accordance with guidelines of NUREG-0313, Rev. 2 and requirements of Regulatory Guide 1.43 for the control of stainless steel cladding of low-alloy steels. Inservice inspection governed by plant-specific aging management program.	***(1) Scope of Program:*** The program is focused on managing the effects of SCC of SS cladding on the intended function of the heat exchanger vessel. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of austenitic SSs and weld metal, with a maximum carbon of 0.035% and minimum 7.5% ferrite in weld metal. Furthermore, hydrogen water chemistry and stringent control of conductivity is used to inhibit IGSCC. ***(3) Parameters Monitored/ Inspected:*** Governed by plant-specific aging management program. ***(4) Detection of Aging Effects:*** Governed by plant-specific aging management program. ***(5) Monitoring and Trending:*** Governed by plant-specific aging management program. ***(6) Acceptance Criteria:*** Governed by plant-specific aging management program. ***(7) Corrective Actions:*** Governed by plant-specific aging management program.. ***(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.	Yes. Elements 3 through 7 should be further evaluated

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E3.4.2	Regenerative Heat Exchanger	Shell	SS	Oxygenated water at 288°C and 10 MPa max.	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E3.5.1	Non-Regenerative Heat Exchanger	Tubing	SS	Oxygenated water at 288°C and 10 MPa max.	Crack Initiation and Growth	SCC, IGSCC	NUREG-0313, Rev. 2. NRC GL 8-01. NRC GL 88-01, S1.
E3.5.1	Non-Regenerative Heat Exchanger	Tubing	SS	Oxygenated water at 288°C and 10 MPa max.	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E3.5.2	Non-Regenerative Heat Exchanger	Shell	HSLAS with SS Cladding	Oxygenated water at 188°C and 1 MPa max.	Crack Initiation and Growth	SCC, IGSCC	NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S1. NRC IN 90-29.
E3.5.2	Non-Regenerative Heat Exchanger	Shell	SS	Oxygenated water at 188°C and 1 MPa max.	Cumulative Fatigue Damage	Fatigue	ASME Section III, 1989 Edition. ANSI B31.1. GSI-190.
E3.6.1	Filter/ Demineralizer	Internals	SS	Oxygenated water at 66°C and 1 MPa max.	Crack Initiation and Growth	SCC, IGSCC	NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, S1. NRC IN 90-29.

VII E3-8

VII E3-9

VII E3-10

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ***(10) Operating Experience:*** Cracking has occurred in BWR pressure vessel weld clad and the adjacent heat-affected zone of the base metal, as described in IN 90-29. The comprehensive AMP outlined in NUREG-0313 and GL 88-01 is based on substantial effort in research and development, and industry recommendations developed in response to NRC communications. The program addresses improvements in the three elements that cause IGSCC, e.g., a susceptible (sensitized) material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring structural integrity of austenitic stainless steel piping.	Yes. Elements 3 through 7 should be further evaluated
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NB, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed.	Yes TLAA
Same as the effect of stress corrosion cracking on Item E3.1: Piping and Fittings beyond second Isolation Valve.	*Same as the effect of stress corrosion cracking on Item E3.1: Piping and Fittings beyond second Isolation Valve.*	Yes. Elements 3 through 7 should be further evaluated
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NB, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed.	Yes TLAA
Same as the effect of stress corrosion cracking on Item E3.4: Regenerative Heat Exchanger Shell.	*Same as the effect of stress corrosion cracking on Item E3.4: Regenerative Heat Exchanger Shell.*	Yes. Elements 3 through 7 should be further evaluated
Components have been designed or evaluated for fatigue for a 40 y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NB, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF).	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and Generic Safety Issue (GSI)-190 is to be addressed.	Yes TLAA
Same as the effect of stress corrosion cracking on Item E3.4: Regenerative Heat Exchanger Shell.	*Same as the effect of stress corrosion cracking on Item E3.4 Regenerative Heat Exchanger Shell.*	Yes. Elements 3 through 7 should be further evaluated

VII E3-8

VII E3-9

VII E3-10

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.3

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VII E3-1	Auxiliary Systems Reactor Water Cleanup System	All			Inconsistent treatment of valves. Some sections address body, bonnet, seal flange and closure bolting while other sections address only body & bonnet. Section VIII B2.2 addresses only valve body and bolting, and does not address valve bonnet.
VII E3-2	Auxiliary Systems Reactor Water Cleanup System	E3.1, E3.2 E3.4, E3.5, E3.6	VII E3-1		Beyond the isolation valves, the RWCU system is generally not safety related and not required to cope with the regulated events, and therefore not in the scope of License Renewal.
VII E3-3	Auxiliary Systems Reactor Water Cleanup System	E3.1.1	VII E3-4, 5		The report does not differentiate between piping >200°F and piping <200°F. A significant amount of piping in this system operates below 200°F, and therefore is not subject to the scope of GL 88-01.
VII E3-4	Auxiliary Systems Reactor Water Cleanup System	E3.1.1	VII E3-4, 5		GL 88-01 supplement 1 states that RWCU piping downstream of the isolation valves will be exempt from the requirements of this letter following licensee implementation of GL 89-10 requirements on the motor operated isolation valves. Since GL 88-01 does not impose any ongoing requirements on this piping, it is not an appropriate reference for AMP.
VII E3-5	Auxiliary Systems Reactor Water Cleanup System	E3.2.1, E3.2.2	VII E3-6, 7		The RWCU pump is located downstream of the isolation valves. GL 88-01 supplement 1 states that RWCU piping downstream of the isolation valves will be exempt from the requirements of this letter following licensee implementation of GL 89-10 requirements on the motor operated isolation valves. Since GL 88-01 does not impose any ongoing requirements on this portion of the system, it is not an appropriate reference for AMP.
VII E3-6	Auxiliary Systems Reactor Water Cleanup System	E3.2.4	VII E3-6, 7, 8, 9, 10, 11		Since the RWCU pumps are generally not considered safety related, the closure bolting is not subject to the scope of GL 91-17. This pump is not ASME Class 1, and would not be subject the Section XI Subsection IWB inspection requirements.

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.3

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VII E3-7	Auxiliary Systems Reactor Water Cleanup System	E3.3.1, E3.3.2, E3.3.3, E3.3.4	VII E3-10, 11, 12, 13		Quality Group D valves in the RWCU system are not within the scope of the referenced documents and associated AMPs.
VII E3-8	Auxiliary Systems Reactor Water Cleanup System	E3.4.1, E3.4.2	VII E3-12, 13, 14, 15		Above comments apply to RWCU heat exchangers, which are also located downstream of the isolation valves and considered non-safety related.
VII E3-9	Auxiliary Systems Reactor Water Cleanup System	E3.6.1	VII E3-14, 15		The filter demineralizers operate below 200°F, and therefore are not subject to the scope of GL 88-01.
VII E3-10	Auxiliary Systems Reactor Water Cleanup System	E3.6.1	VII E3-14, 15		The filter demineralizers are located downstream of the isolation valves. GL 88-01 supplement 1 states that RWCU piping downstream of the isolation valves will be exempt from the requirements of this letter following licensee implementation of GL 89-10 requirements on the motor operated isolation valves. Since GL 88-01 does not impose any ongoing requirements on this portion of the system, it is not an appropriate reference for AMP.

E4. Coolant Storage/Refueling Water Cleanup System

E4.1 Refueling Water Tank (RWT) Heating

- E4.1.1 Piping and Fittings

E4.2 RWT Circulation Pump

- E4.2.1 Bowl/Casing
- E4.2.2 Bolting

E4.3 Valves

- E4.3.1 Body & BONNET VII E4-8

E4.4 Heat Exchanger (RWT Heating)

- E4.4.1 Bonnet or Cover
- E4.4.2 Tubing
- E4.4.3 Shell

E4.5 Refueling Water Tank

- E4.5.1 Shell
- E4.5.2 Manhole
- E4.5.3 Penetrations/Nozzles
- E4.5.4 Tank Heating Coil
- E4.5.5 Manhole Bolting
- E4.5.6 Perimeter Seal

E4. Coolant Storage/Refueling Water System

System, Structures, and Components

The system, structures, and components included in this table comprise the pressurized water reactor (PWR) coolant storage system and consist of the refueling water tank (RWT) and, if used, the refueling water heating system including circulation pump, heat exchanger, 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," the refueling water tank is classified as Group B Quality Standards and the refueling water heating system as Group C.

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

System Interfaces

The system that interfaces with the coolant storage/refueling water system is the emergency core cooling system (Table V D1).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E4.1.1	Refueling Water Tank (RWT) Heating (if used)	Piping & Fittings	Stainless Steel (SS)	Up to 65°C Chemically Treated Borated Water	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44. NRC IN 80-38. NRC IN 84-18. NRC IN 89-02. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19. EPRI TR 102134.

DELETE VII E4-1

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The applicable AMP relies on material selection guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels, monitoring and maintaining water chemistry in accordance with the guidelines of EPRI TR 102134 and implemented by the plant technical specifications, and inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling, containment heat removal, atmosphere cleanup, and reactor residual heat removal. DELETE PER VII E4-1	***(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 component. ***(2) Preventive Actions:*** Selection of material in compliance with the requirements of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens and oxygen in the primary water to less than 5 and 0.01 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. However, preventive actions are considered inadequate because of inadvertent introduction of contaminants into the coolant system either due to unacceptable levels of contaminants in the boric acid, or introduced through the free surface of spent fuel pool which can be a natural collector of airborne contaminants [NRC Information Notice (IN) 84-18]. 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 component by detecting leakage by ISI. Inspection requirements of ASME Section XI Table IWD 2500-1 category D-B specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 3 components in support of emergency core cooling, containment heat removal, and reactor residual heat removal. ***(4) Detection of Aging Effects:*** Degradation of the component due to SCC cannot occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant SCC is not occurring. Based on piping/ component geometry and fluid flow conditions, susceptible locations can be identified and evaluated. ***(5) Monitoring and Trending:*** System leakage test under Section XI is conducted at ≈40-month intervals. However, this may not be sufficiently frequent to detect the effects of this ARD, and a supplemental inspection program may be needed. ***(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. ***(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	Yes Elements 4 and 5 should be further evaluated

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E4.1.1	Refueling Water Tank (RWT) Heating (if used)	Piping & Fittings	SS	Up to 65°C Chemically Treated Borated Water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ NRC IN 84-18. NRC IN 96-11. Plant Technical Specifications. EPRI TR ~~102134.~~ 105714 VII E4-9

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) ~~94-18), charging pump casing cladding (INs 80-38 and 94-63), internal bolting in swing check valves (IN 89-02), and instrument nozzles in safety injection tanks (IN-91-05).~~	
The applicable AMP relies on minimizing impurities by monitoring and maintaining water chemistry in accordance with the guidelines of EPRI TR 102134 and implemented by the plant technical specifications, and inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling, containment heat removal, atmosphere cleanup, and reactor residual heat removal. VII E4-9 PRIMARY WATER CHEMISTRY PROGRAM (SEE CHANGE #11) INSERT #9	***(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 coolant storage/refueling water system components. ***(2) Preventive Actions:*** Control of halogens and oxygen in the primary water to less than 5 and 0.01 ppm, respectively, during operation, and monitor and control of water chemistry during shut down. However, preventive actions are considered inadequate because of inadvertent introduction of contaminants into the coolant system either due to unacceptable levels of contaminants in the boric acid, or introduced through the free surface of spent fuel pool which can be a natural collector of airborne contaminants [NRC Information Notice (IN) 84-18]. ***(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 Table IWD 2500-1 category D-B specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 3 components in support of emergency core cooling, containment heat removal, and reactor residual heat removal. ***(4) Detection of Aging Effects:*** Degradation of the component due to crevice and pitting corrosion cannot occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant crevice and pitting corrosion is not occurring. Based on piping/ component geometry and fluid flow conditions, susceptible locations can be identified and evaluated. ***(5) Monitoring and Trending:*** System leakage test under Section XI is conducted at ~40-month intervals. However, this may not be sufficiently frequent to detect the effects of this ARD, and a supplemental inspection program may be needed. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWD-3000. ***(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 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. The potential exists for introduction of	~~Yes~~ ~~[illegible]~~ ~~and~~ ~~should be~~ ~~further~~ ~~evaluated~~ NO SEE CHANGE #11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM

VII AUXILIARY SYSTEMS

E4. COOLANT STORAGE/REFUELING WATER SYSTEM (Pressurized Water System)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E4.2.1	RWT Circulation Pump	Bowl/Casing	SS	65°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. NRC IN 84-18. NRC IN 94-63. NRC IN 96-11. NRC IN 98-23. Plant Technical Specifications. EPRI TR ~~102134.~~ 105714 VII E4-9

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~impurities into the coolant system as contaminants in the boric acid or introduced through the free surface of spent fuel pool [IN 84-18], or from ingress of demineralizer resins (IN 96-11).~~	
The AMP relies on monitoring and maintaining water chemistry in accordance with the guidelines of EPRI TR 102134 and implemented by the plant technical specifications; 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, containment heat removal, atmosphere cleanup, and reactor residual heat removal; and based on the testing requirements of 10 CFR 50.55a for ASME Code Class 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. VII E4-9 PRIMARY WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	~~(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 the components. *(2) Preventive Actions:* Control of halogens and oxygen in the primary water to less than 5 and 0.01 ppm, respectively, during operation, and monitor and control of water chemistry during shut down. However, preventive actions are considered inadequate because of inadvertent introduction of contaminants into the coolant system either due to unacceptable levels of contaminants in the boric acid, or introduced through the free surface of spent fuel pool which can be a natural collector of airborne contaminants [NRC Information Notice (IN) 84–18]. The ~~AMP must therefore rely on ISI 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, Table IWD 2500-1, category D-B, specify visual VT-2 (IWA-5240) examination during system leakage test and hydrostatic test of all pressure retaining Class 3 components in support of emergency core cooling, containment heat removal, and reactor residual heat removal. Based on the requirements of 10 CFR 50.55a for ASME Code Class 3 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 crevice and pitting corrosion cannot occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant crevice and pitting corrosion is not occurring. Based on piping/ component geometry and fluid flow conditions, susceptible locations can be identified and evaluated. *(5) Monitoring and ~~Trending:~~* ~~System leakage test under Section XI is~~ conducted at ≈40-month intervals. However, this may not be sufficiently frequent to detect the aging effects, and a supplemental inspection program may be needed. *(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. *(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	~~Yes, Elements 4, 5 and 7 should be further evaluated~~ NO SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM.

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E4.2.2	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~~ CORROSION	NRC GL 88-05. ~~ASME Section XI, 1989 Edition.~~ NRC IN 86-108 S 3.

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VII E4-6

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) for the period of license renewal. ***(10) Operating Experience:*** Localized corrosion is likely to occur at crevice geometry where buildup of impurities can occur. The potential exists for introduction of impurities into the coolant system as contaminants in the boric acid or introduced through the free surface of spent fuel pool (IN 84–18), or from ingress of demineralizer resins (IN 96-11). Corrosion has been observed in safety injection systems, e.g., guide rings of relief valves (IN 98-93) and charging pump casing (IN 94-63).	
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 IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling, containment heat removal, atmosphere cleanup, and reactor residual heat removal. VII E4-6 BORIC ACID CORROSION PROGRAM (SEE CHAPTER #11)	***(1) Scope of Program:*** The staff guidance of Generic Letter (GL) 88-05 provides assurances that a program has been implemented consisting of 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 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:*** Extent and frequency of inspection appear to be adequate to detect aging effects. ***(5) Monitoring and Trending:*** System leakage test under Section XI is conducted at ≈40-month intervals. ***(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. ***(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:*** 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	No SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE BORIC ACID CORROSION PROGRAM.

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E4.3.1	Valves (Check Valves, Control Valves, Hand Valves)	Body and Bonnet	SS, CS with SS Cladding	Up to 65°C Chemically Treated Borated Water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ NRC IN 84-18. NRC IN 94-63. NRC IN 96-11. NRC IN 98-23. Plant Technical Specifications. EPRI TR ~~102134.~~ 105714 VIIE4-9

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ 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.	
The AMP relies on monitoring and maintaining water chemistry in accordance with the guidelines of EPRI TR 102134 and implemented by the plant technical specifications; 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, containment heat removal, atmosphere cleanup, and reactor residual heat removal. VII E4-9 PRIMARY WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	~~(1) Scope of Program: The program relies on preventive~~ measures to mitigate crevice or pitting corrosion and combination of inservice inspection (ISI) to monitor the effects of corrosion on the intended function of the components. *(2) Preventive Actions:* Control of halogens and oxygen in the primary water to less than 5 and 0.01 ppm, respectively, during operation, and monitor and control of water chemistry during shut down. However, preventive actions are considered inadequate because of inadvertent introduction of contaminants into the coolant system either due to boric acid, or introduced through the free surface of spent fuel pool which can be a natural collector of airborne contaminants [NRC Information Notice (IN) 84-18]. *(3) Parameters Monitored/Inspected:* ~~The AMP monitors the effects of corrosion by ISI to detect~~ coolant 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 test of all pressure retaining Class 3 components. *(4) Detection of Aging Effects:* Degradation of the component due to crevice and pitting corrosion cannot occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant degradation is not occurring. Based on piping/ ~~component geometry and fluid flow conditions,~~ susceptible locations can be identified and evaluated. *(5) Monitoring and Trending:* System leakage test under Section XI is conducted at ≈40-month intervals. However, this may not be sufficiently frequent to detect the effects of this ARD, and a supplemental inspection program may be needed. *(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. *(7) Corrective Actions:* Prior to service, corrective measures are needed to meet the requirements ~~of IWA-3000. 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 crevice geometry where buildup of impurities can occur. The potential exists for introduction of impurities into the coolant	~~Yes. Elements 4 and 5 should be further evaluated~~ NO SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E4.4.1 thru E4.4.3	Heat Exchanger (if used) (RWT Heating)	Bonnet or Cover, Tubing, Shell	Bonnet/ Cover & Tubing: SS, Shell: CS	Chemically Treated Borated Water; and Chemically Treated Heating Water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~ NRC IN 84-18. EPRI TR-105714
E4.4.3, E4.4.4	Heat Exchanger (if used) (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. NRC IN 86-108 S3.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	[redacted] system as contaminants in the boric acid or introduced through the free surface of spent fuel pool (IN 84-18), or from ingress of demineralizer resins (IN 96-11). Corrosion has been observed in safety injection systems, e.g., guide rings of relief valves (IN 98-[illegible]) and charging pump casing (IN 94-63).	
Inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for systems in support of emergency core cooling, and mitigation of corrosion by controlling system water chemistry to minimize exposure to aggressive environments. VII E4-9 PRIMARY WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	~~*(1) Scope of Program:* The program is focused on managing~~ the effects of corrosion on the intended function of RWT heat exchanger. ***(2) Preventive Actions:*** Monitor and control of reactor coolant system and component cooling system water chemistry to minimize impurities, and timely corrective action prevent or mitigate corrosion. However, preventive actions are considered inadequate because of inadvertent introduction of contaminants into the coolant system [NRC Information Notice (IN) 84-18]. ***(3) Parameters Monitored/ Inspected:*** The program manages the effects of corrosion on the function of the heat exchanger by detection of leakage in the component cooling system. Corrective actions are taken when acceptable limits are exceeded. Inspection requirements of ASME Section XI, Table IWD 2500-1, examination category D-B specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 3 components in support of emergency core cooling, containment heat removal, and reactor residual heat removal. ***(4) Detection of Aging Effects:*** Degradation of the component due to crevice and pitting corrosion cannot occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant degradation is not occurring. Based on component geometry and fluid flow conditions, susceptible locations can be identified and evaluated. ***(5) Monitoring and Trending:*** System leakage test under Section XI is conducted at ≈40-month intervals. However, this may not be sufficiently frequent to detect the effects of this ARD, and a supplemental inspection program may be needed. ***(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. ***(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:*** The present AMP has been effective in managing the effects of corrosion in RWT heat exchanger.	[redacted] NO SEE CHAPTER 11 FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM
Same as effect of Corrosion/Boric Acid Wastage of external surfaces of Items E4.2.2 RWT circulation pump bolting.	*Same as effect of Corrosion/Boric Acid Wastage of external surfaces of Items E4.2.2 RWT circulation pump bolting.*	

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E4. COOLANT STORAGE/REFUELING WATER SYSTEM (Pressurized Water System)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E4.5.1 thru E4.5.3	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.~~ NRC IN 84-18. NRC IN 96-11. Plant Technical Specifications. EPRI TR ~~102134~~ 105714 VII E4-9

VII AUXILIARY SYSTEMS

E4. COOLANT STORAGE/REFUELING WATER SYSTEM (Pressurized Water System)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The applicable AMP relies on minimizing impurities by monitoring and maintaining water chemistry in accordance with the guidelines of EPRI TR 102134 and implemented by the plant technical specifications, and inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, test and examination category C-H for pressure retaining Class 2 components. VII E4-9 PRIMARY WATER CHEMISTRY PROGRAM (SEE CHAPTER #11)	***(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 coolant storage/refueling water system components. ***(2) Preventive Actions:*** Control of halogens and oxygen in the primary water to less than 5 and 0.01 ppm, respectively, during operation, and monitor and control of water chemistry during shut down. However, preventive actions are considered inadequate because of inadvertent introduction of contaminants into the coolant system either due to unacceptable levels of contaminants in the boric acid, or introduced through the free surface of spent fuel pool which can be a natural collector of airborne contaminants [NRC Information Notice (IN) 84-18]. ***(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 Table IWD 2500-1 category C-H specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 2 components. ***(4) Detection of Aging Effects:*** Degradation of the component due to crevice and pitting corrosion cannot occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant degradation is not occurring. Based on component geometry and fluid flow conditions, susceptible locations can be identified and evaluated. ***(5) Monitoring and Trending:*** System leakage test under Section XI is conducted at ≈40-month intervals. However, this may not be sufficiently frequent to detect the effects of this ARD, and a supplemental inspection program may be needed. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3516. ***(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 because of buildup of impurities due to stagnant conditions. The potential exists for introduction of impurities into the coolant system as contaminants in the boric acid or introduced through the free surface of spent fuel pool (IN 84-18), or from ingress of demineralizer resins (IN 96-11).	[redacted] NO SEE CHAPTER II FOR EVALUATION AND TECHNICAL BASIS FOR THE PRIMARY WATER CHEMISTRY PROGRAM

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E4. COOLANT STORAGE/REFUELING WATER SYSTEM (Pressurized Water System)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E4.5.3	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. NRC IN 80-38. NRC IN 84-18. NRC IN 89-02. NRC IN 91-05. NRC IN 94-63. NRC IN 97-19. EPRI TR 102134.

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DELETE PER VII E4-1

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The applicable AMP relies on material selection guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels, monitoring and maintaining water chemistry in accordance with the guidelines of EPRI TR 102134 and implemented by the plant technical specifications, and inservice inspection is in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and 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) of stainless steel (SS) and inservice inspection (ISI) to monitor the effects of SCC on the intended function of the component. ***(2) Preventive Actions:*** Selection of material in compliance with the requirements of Regulatory Guide (RG) 1.44 prevents or mitigates SCC. Control of halogens and oxygen in the primary water to less than 5 and 0.01 ppm, respectively, during operation, and monitor and control of water chemistry during shut down, mitigate potential of SCC. However, preventive actions are considered inadequate because of inadvertent introduction of contaminants into the coolant system either due to unacceptable levels of contaminants in the boric acid, or introduced through the free surface of spent fuel pool which can be a natural collector of airborne contaminants [NRC Information Notice (IN) 84-18]. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors the effects of SCC on intended function of the component by detecting leakage by ISI. Inspection requirements of ASME Section XI Table IWD 2500-1 category C-H specify visual VT-2 (IWA-5240) examination during system leakage test and system hydrostatic test of all pressure retaining Class 2 components. ***(4) Detection of Aging Effects:*** Degradation of the component due to SCC cannot occur without leakage of coolant. However, extent and frequency of inspection may be inadequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant SCC is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified and evaluated. ***(5) Monitoring and Trending:*** System leakage test under Section XI is conducted at ≈40-month intervals. However, this may not be sufficiently frequent to detect the effects of this ARD, and a supplemental inspection program may be needed. ***(6) Acceptance Criteria:*** Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with IWC-3516. ***(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), internal bolting in swing check valves (IN 89-02), and instrument nozzles in safety injection tanks (IN 91-05).	Yes Elements 4 and 5 should be further evaluated

VII AUXILIARY SYSTEMS
E4. COOLANT STORAGE/REFUELING WATER SYSTEM (Pressurized Water System)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E4.5.4	Refueling Water Tank (RWT)	Heating Coil	SS	Chemically Treated Borated Water; and Chemically Treated Heating Water	Loss of Material	Crevice and Pitting Corrosion	~~ASME Section XI, 1989 Edition.~~
E4.5.5	Refueling Water Tank (RWT)	Manhole 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.~~ NRC IN 86-108 S3.
E4.5.6	Refueling Water Tank (RWT)	Perimeter Seal	Cold Plastic Coal Tar Pitch Flashing	Air	Loss of elasticity (drying out)	Weathering	-

VII E4-9

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes no generic AMP
Same as effect of Corrosion/Boric Acid Wastage of external surfaces of Items E4.2.2 RWT circulation pump bolting.	*Same as effect of Corrosion/Boric Acid Wastage of external surfaces of Items E4.2.2 RWT circulation pump bolting.*	No
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes no generic AMP

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.4

GALL SECTION	TITLE	ITEM NO.	PAGE	REVIEWER	COMMENT
VII E4-1	Coolant Storage/Refueling Water System (PWR)	E4.1.1, and E4.5.3	VII E4-4 through 7, 18 and 19		Delete Stress Corrosion Cracking as an aging mechanism. This system's components are not above 200°F; therefore SCC is not a valid aging mechanism.
VII E4-2	Coolant Storage/Refueling Water System (PWR)	E4.1.1, E4.2.1, E4.3.1, E4.4.1, E4.4.2, E4.4.3, E4.5.1, E4.5.2 & E4.5.3	VII E4-5, 7, 9, 13, 15, 17 and 19		(SCC is not considered to be valid mechanism, see separate comment above. Comments to follow assume that the SCC Aging Mechanism is retained in Report Despite other comment.) In **'Evaluation Technical Basis'** for Stress Corrosion Cracking and for Crevice and Pitting Corrosion the program element 4, Detection of Aging Effects, states degradation cannot occur without coolant leakage. This statement is not correct when applied to an environment of chemically treated borated water.
VII E4-3	Coolant Storage/Refueling Water System (PWR)	E4.1.1	VII E4-4 and 5		(SCC is not considered to be valid mechanism, see separate comment above. Comments to follow assume that the SCC Aging Mechanism is retained in Report Despite other comment.) SCC is listed as an Aging Mechanism for RWT Heating Piping. Material selection guidelines in accordance with RG 1.44 are not an AMP; they are a design feature and as such should not be listed. ISI/IST is listed in the **'Existing AMP'** but the **'Evaluation and Technical Basis'** section appears to indicate that ISI/IST (in the guise of VT-2 exams) is not adequate to discover SCC. A supplemental inspection program is indicated instead. Since ISI/IST is not actually to be credited, it should not be listed.

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.4

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VII E4-4	Coolant Storage/Refueling Water System	E4.5.3	VII E4-16 and 17		SCC is listed as an Aging Mechanism for the RWT Penetrations/ Nozzles. (SCC is not considered to be valid mechanism, see separate comment above. Comments to follow assume that the SCC Aging Mechanism is retained in Report Despite other comment.) This mechanism was considered Plausible for CCNPP but the root cause appeared to be contaminants not removed during initial fabrication. This is a plant-specific event and this entry may not provide any useful information to other prospective applicants. In addition, material selection guidelines in accordance with RG 1.44 are not an AMP; they are a design feature and as such should not be listed. In addition, the plant chemistry program should not be listed as an AMP in this case because the condition of the process fluid has no bearing on the conditions required for external SCC. Condensation provided the aqueous environment necessary for initiation of SCC, and the level of any impurities in the RWT fluid was not a contributing factor. Also, ISI/IST is listed as in **'Existing AMP'** but the **'Evaluation and Technical Basis section'** appears to indicate that ISI/IST (in the guise of VT-2 exams) is not adequate to discover SCC. A supplemental inspection program is indicated instead. Since ISI/IST is not actually to be credited, it should not be listed.
VII E4-5	Coolant Storage/Refueling Water System (PWR)	E4.2.2	VII E4-11		In **'Evaluation Technical Basis'** for Corrosion / Boric Acid Wastage, program element 4, Detection of Aging Effects, does not state this mechanism requires coolant leakage. The statement 'Degradation of component due to wastage cannot occur without leakage of coolant.' Should be added to program element 4, Detection of Aging Effects.
VII E4-6	Coolant Storage/Refueling Water System (PWR)	E4.2.2 and E4.5.5	VII E4-10, 11, 20 and 21		Corrosion / Boric Acid Wastage should rely on the NRC GL 88-05 program only. (The Boric Acid Corrosion Inspection Program itself was deemed adequate for aging management in the CCNPP SER). Delete reference to ASME activities in all columns. No action should be listed in the **'Further Evaluation'** column. Refer to AMA titled *'Boric Acid Corrosion Program'* in lieu of listed AMP.

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.4

GALL SECTION	TITLE	ITEM NO	PAGE	REVIEWER	COMMENT
VII E4-7 Note 1	Coolant Storage/Refueling Water System (PWR)	E4.2.2 and E4.5.5	VII E4-10 and 20		In some Sections (V.D1, VII.E4) Corrosion/Boric Acid Wastage of External Surfaces is an Aging Mechanism, in other Sections (VII.E1) Boric Acid Corrosion is referred to. It seems that these are the same Aging Mechanism. The terminology should be consistent throughout. Use the terminology "Boric Acid Corrosion". (This comment applies beyond the referenced Sections.) Refer to AMA titled *'Boric Acid Corrosion Program'* in lieu of listed program
VII E4-8	Coolant Storage/Refueling Water System (PWR)	E4.3.1	VII E4-1		This section table of contents should be Body and Bonnet, not just Body. (Page E4-12 lists E4.3.1 as Body and Bonnet.)
VII E4-9	Coolant Storage/Refueling Water System (PWR)	E4.1.1, E4.2.1, E4.3.1, E4.4.1, E4.4.2, E4.4.3, E4.5.1, E4.5.2, E4.5.3 & E4.5.4	VII E4-6 through 17, E4-20 and 21		Crevice and Pitting Corrosion is controlled by the chemistry control program alone. The Chemistry Program should comply with EPRI TR-105714 (not TR-102134). Delete references to ASME inspections in all columns. No action should be listed in the **'Further Evaluation'** column. Refer to AMA titled *'Chemistry Program (Primary)'* in lieu of listed program

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

E5. Shutdown Cooling System (Older BWR)

System, Structures, and Components

The system, structures, and components included in this table comprise the shut-down cooling (SDC) system for the older vintage boiling water reactors (BWRs) and consist of piping and fittings, SDC system pump, heat exchanger, and valves. Based on 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 SDC system are classified as Group B Quality Standards.

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

System Interfaces

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

VII AUXILIARY SYSTEMS

E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E5.1.1	Piping	Piping and Fittings	Carbon Steel (CS), Stainless Steel (SS)	Oxygenated Water, Up to 288°C	Loss of Material (for CS components)	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. Plant Technical Specifications.
E5.1.1	Piping	~~Piping and Fittings~~	~~CS, SS~~	~~Oxygenated Water, Up to 288°C~~	~~Cumulative Fatigue Damage~~	~~Fatigue~~	~~ASME Section III, 1989 Edition. ANSI B31.P. GSI-190.~~

This TLAA will be captured in the SRP. Delete from GALL

VII E5.1

VII E5-2

See Chapter XI for an Evaluation of 10CFR50.55a/ ASME Section XI (for Class 1, 2 & 3 components) and on evaluation of Primary Water Chemistry

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~The applicable AMP relies on minimizing impurities by monitoring and maintaining water chemistry in accordance with the Plant Technical Specifications, 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.~~ Primary Water Chemistry 10CFR50.55a/ ASME Section XI, Table IWC 2500.	~~*(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 shut-down 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 Plant Technical Specifications. *(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 according to Table IWC 2500-1 category C-H. *(4) Detection of Aging Effects:* Degradation of the component due to corrosion is commonly accompanied by leakage of coolant. However, the extent of inspection may not be adequate; inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified and evaluated. *(5) Monitoring and Trending:* Inspection schedule of ASME Section XI should provide for timely detection of leakage. System leakage test is conducted at ≈40-month intervals, 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 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. 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
~~Components have been designed or evaluated for fatigue for a 40-y design life, according to the requirements of ASME Section III (edition specified in 10 CFR 50.55a), Subsection NC, or ANSI B31.1, or other evaluations based on cumulative usage factor (CUF).~~	Fatigue is a time-limited aging analysis (TLAA) ~~to be performed for the period of license renewal, and Generic Safety Issue (GSI) 190 is to be addressed.~~	~~Yes~~ TLAA

VII AUXILIARY SYSTEMS

E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E5.1.1	Piping	Piping and Fittings	SS	Oxygenated Water, Up to 288°C	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 88-01, Sup. 1. ASME Section XI, 1989 Edition. BWRVIP-29. EPRI TR-103515.

See Chapter XI for an evaluation of 10CFR50.55a / ASME Section XI (for Class 1, 2, and 3 components) and an evaluation of the Primary Water Chemistry Program.

VII E5-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Program delineated in NUREG-0313, Rev. 2 and implemented through NRC Generic letter (GL) 88-01 and its Supplement 1, and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-F-1 for pressure retaining welds in Class 2 stainless steel piping, and testing category C-H for system leakage. Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and growth.~~ 10CFR50.55a / ASME Section XI, Table 2500-1, Categories C-F and C-H Primary Water Chemistry. VII E5-2	~~*(1) Scope of Program:* The program is focused on managing the effects of IGSCC on the intended function of austenitic stainless steel (SS) piping 4 in. or larger in diameter and contains reactor water at a temperature above 93°C (above 200°F) during power operation regardless of Code classification. It also applies to reactor vessel attachments and appurtenances. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by 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 (SI). Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and growth. Also, hydrogen water chemistry and stringent control of conductivity is used to inhibit IGSCC. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of IGSCC on the intended function of primary coolant system piping by detection and sizing of cracks by inservice inspection (ISI). ASME Section XI Table IWC 2500-1, examination category C-F-1, specifies for circumferential and longitudinal welds in each pipe or branch run NPS 4 or larger, volumetric and surface examination of ID region extending 1/4 in. on either side of the weld and 1/3 wall thickness deep, and surface examination of OD surface extending 1/2 in. on either side. Surface examination is conducted for circumferential and longitudinal welds in each pipe or branch run less than NPS 4. For socket welds, surface examination is specified of OD surface extending 1 in. on the buttered side and 1/2 in. on the other. 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. ***(4) Detection of Aging Effects:*** Aging degradation of the piping can not occur without crack initiation; extent and schedule of inspection assure detection of cracks before the loss of intended function of austenitic SS piping and fittings. ***(5) Monitoring and Trending:*** Inspection schedule of ASME Section XI provides for timely detection of cracks. Inspection schedule and sample size specified in Table 1 of GL 88-01 are based on the condition of each weld and are adequate for timely detection of cracks. Welds of~~	No

VII AUXILIARY SYSTEMS

E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

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

VII AUXILIARY SYSTEMS

E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

VII E5-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ resistant material are as a minimum examined according to an extent and frequency comparable to those of ASME Section XI, e.g., 25% are examined every 10 y, at least 12% in 6 y. Inspection extent and schedule are enhanced for welds of non-resistant materials, or welds that have been treated by SI or reinforced by weld overlay. ***(6) Acceptance Criteria:*** Any IGSCC degradation is evaluated in accordance with IWB-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3514. Planar and liner flaws are sized according to IWA-3300 and IWA-3400. ***(7) Corrective Actions:*** Repair and reexaminations are in conformance with IWA-4000. 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 outlined in NUREG-0313 and GL 88-01 is based on substantial effort in research and development, and industry recommendations developed in response to NRC communications. The program addresses improvements in the three elements that cause IGSCC, e.g., a susceptible (sensitized) material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring structural integrity of the primary coolant pressure ~~boundary.~~	

VII AUXILIARY SYSTEMS

E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E5.1.2	Piping	Bolting	Low-Alloy Steel	Air, Metal Tempera-tures up to 288°C	Attrition	Wear	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. NRC Bull 89-02. NRC IN 90-68 S1. ASME Section XI. 1989 Edition.

VII E5-3

See Chapter XI for an evaluation of 10CFR50.55a / ASME Section XI (for Class 1, 2, and 3 components)

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; and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination categories C-D for pressure retaining bolting in Class 2 components, and te~~sting category C-H for system~~ leakage. 10CFR50.55a/ASME Section XI, Table IWC, Categories C-D and CH	~~*(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. The use of A 286 SS torqued to a stress >100 ksi for pump internal bolting is not recommended (IN 90-68 S1). Also, hardness of internal preload Type 410 SS and 17-4PH bolting is limited to Rockwell R_C26 (Bull 89-02). ***(3) Parameter Monitored/ Inspected:*** The AMP monitors the effects of aging degradation on the intended function of closure bolting by detection of coolant 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 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 and 3517. Any relevant conditions that may be detected during the leakage and hydrostatic tests are ~~compared with the~~	No

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
E5.2.1	Pump	Bowl/Casing	CS	Oxygenated Water, Up to 288°C	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.

VII E5-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ acceptance standards of IWC-3516. ***(7) Corrective Actions:*** Repair and replacement is in conformance with IWA-4000 and 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:*** Significant number of incidents have been reported on bolts and nuts that have failed or become degraded because of SCC. Examples of affected fasteners include (a) steam generator and pressurizer manway closures, (b) valve bonnets and pump flange connections on lines 6 in. or greater, and (c) control rod drive and pressurizer heater connections. The bolting integrity programs developed in accordance with commitments made in response to NRC communications on bolting events have provided effective means of ensuring bolting reliability.	
~~The applicable AMP is based on~~ guidelines given in the Plant Technical Specifications and relies on minimizing impurities by monitoring and maintaining water chemistry conditions. 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.~~ 10CFR50.55a/ASME Section XI, Table IWC 2500. 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 shut-down 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 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; 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 IWB-3516 for Class 2~~	Yes, Element 2 should be further evaluated.

See Chapter XI for an evaluation of 10CFR50.55a/ASME Section XI (for Class 1, 2, and 3 components) and an evaluation of Primary Water Chemistry.

VII E5-2

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E5.2.2	Pump	Bolting	Low-Alloy Steel	Air, Leaking Oxygenated Water	Attrition	Wear	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. NRC Bull 89-02. NRC IN 90-68 S1. ASME Section XI, 1989 Edition.
E5.3.1	Valves (Check, Control, Hand, Motor Operated, & Relief Valves)	Body and Bonnet	CS Forging, CS Casting, SS Forging, SS Casting	Oxygenated Water, Up to 288°C	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. NRC IN 98-24, Plant Technical Specifications.

VII E5-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ 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 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 flange connections and other crevices where buildup of impurities can occur. No significant corrosion related problem has been reported for pumps in ~~BWR shut-down cooling system.~~	
Same as for Wear of Item E5.1.2 bolting for piping flange connections.	*Same as for Wear of Item E5.1.2 bolting for piping flange connections.*	No
~~The applicable AMP, based on~~ guidelines given in the Plant Technical Specifications and relies on minimizing impurities by monitoring and maintaining water chemistry conditions. 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.~~ Primary Water Chemistry 10CFR50.55a/ASME Section XI, Table IWC-2500 VII E5-2	~~***(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 shut-down cooling system components. ***(2) Preventive Actions:*** Mitigation is by monitoring and control of water chemistry to minimize concentration of corrosive impurities by following guidelines of 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. ***(4) Detection of Aging Effects:*** Degradation of the component due to corrosion would result in leakage of coolant. However, extent of inspection may not be adequate; inspection of representative valves and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. This inspection can be visual if the valve is disassembled, and may be covered by the plant maintenance program. UT thickness measurements could also be used. ***(5) Monitoring and Trending:*** ISI 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~~	~~Yes, Element 4 should be further evaluated~~ No

See Chapter XI for an evaluation of 10CFR50.55a/ASME Section XI (for Class 1, 2, and 3 Components) and an evaluation of Primary Water Chemistry

VII AUXILIARY SYSTEMS

E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E5.3.1	Valves (Check, Control, Hand, Motor Operated, & Relief Valves)	Body and Bonnet	SS Forging, SS Casting	Oxygenated Water, Up to 288°C	Crack Initiation and Growth	SCC	ASME Section XI, 1989 Edition. NUREG-0313, Rev. 2. NRC GL 88-01. NRC GL 89-04. NRC GL 96-05. NRC IN 88-70, BWRVIP-29. EPRI TR-103515.

VII E5-2

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) 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. ***(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).	
Guidelines of ~~NUREG-0313, Rev. 2 and~~ NRC Generic letter (GL) 88-01 and its Supplement 1; and based on plant technical specifications, inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWC 2500-1, examination category C-G for pressure retaining welds in Class 2 valves and testing category C-H for system leakage. Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and ~~growth.~~ 10CFR50.55a/ASME SectionXI, Categories C-G and C-H. 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 intended function of the valves. NUREG-0313 and GL 88-01, respectively, describe the technical basis and staff guidance regarding the problem of IGSCC in BWRs. ***(2) Preventive Actions:*** Mitigation of IGSCC is by selection of material considered resistant to sensitization and IGSCC, e.g., low-carbon grades of cast SSs and weld metal, with a maximum carbon of 0.035% and minimum 7.5% ferrite. Water chemistry is monitored and maintained in accordance with EPRI guidelines in BWRVIP-29 and TR-103515 to minimize the potential of crack initiation and growth. Also, hydrogen water chemistry and stringent control of conductivity is used to inhibit IGSCC. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the effects of SCC on intended function of the valves by detection and sizing of cracks by ISI. Inspection requirements of Table IWC 2500-1 for Class 2 valves, category C-G specifies for all valves in each piping run examined under category C-F-1, surface examination of either the inside or outside surface of all welds extending 1/2 in. on either side of the weld. In a group of multiple valves of similar design, size, function, and service 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 or degradation of pump performance; 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 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	No

See Chapter XI for an evaluation of 10CFR50.55a/ASME SectionXI (for Class 1, 2, and 3 Components) and an evaluation of Primary Water Chemistry

XI E5-2

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E5.3.2	Valves (Check, Control, Hand, Motor Operated, & Relief Valves)	Bolting	Low-Alloy Steel	Air, Metal Tempera-tures up to 288°C	Attrition	Wear	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. NRC Bull 89-02. NRC IN 90-68 S1. ASME Section XI, 1989 Edition.
E5.4.1 thru E5.4.4	Heat Exchanger	Tubes, Tubesheet, Channel & Head, Shell	Tubes: SS; Tubesheet: CS (SS Cladding on Channel Side); Channel & Head: CS; Shell: CS	Oxygenated Water; and Treated Component Cooling Water	Loss of Material	Crevice and Pitting Corrosion	ASME Section XI, 1989 Edition. Plant Technical Specifications.

VII E5-2

VII AUXILIARY SYSTEMS

E5. SHUTDOWN COOLING SYSTEM (Old Boiling Water Reactor)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ period. ***(6) Acceptance Criteria:*** Any SCC degradation is evaluated in accordance with IWC-3100 by comparing ISI results with the acceptance standards of IWC-3400 and IWC-3515. ***(7) Corrective Actions:*** Repair and 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:*** The comprehensive AMP outlined in NUREG-0313 and GL 88-01 addresses improvements in all three elements that cause SCC, e.g., a susceptible material, significant tensile stress, and an aggressive environment, and has provided effective means of ensuring ~~structural integrity of BWR components.~~	
~~Same as for Wear of Item E5.1.2 bolting for piping flange connections.~~ 10CFR50.55a/ASME Section XI, Table IWC, Categories C-D and C-H	~~Same as for Wear of Item E5.1.2 bolting for piping flange connections.~~ See Chapter XI for an evaluation of ASME Section XI, Table IWC.	No
~~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, and mitigation of corrosion by controlling system water chemistry to minimize exposure to aggressive environments in accordance with Plant Technical Specifications.~~ Primary Water Chemistry VII E5-4	~~***(1) Scope of Program:*** The program is focused on managing the effects of corrosion on the intended function of heat exchangers and coolers in shut-down cooling system. ***(2) Preventive Actions:*** Monitor and control of reactor coolant system and component cooling system water chemistry to minimize impurities, and timely corrective action prevent or mitigate corrosion in accordance with Plant Technical Specifications. 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 program manages the effects of corrosion on the function of the heat exchangers by monitoring parameters 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. Corrective actions are taken when acceptable limits are exceeded. 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. ***(4) Detection of Aging Effects:*** Monitoring of dissolved iron and copper, suspended solids, radiation, and temperature would detect the existence of corrosion; frequent monitoring assure timely detection of the effects of corrosion before loss of intended function of heat~~	No

See Chapter XI for an evaluation of 10CFR50.55a/ASME Section XI (for Class 1, 2 & 3 Components).

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
E5.4.5	Heat Exchangers	Bolting	Low-Alloy Steel	Air, Metal Tempera-tures up to 288°C	Attrition	Wear	NUREG-1339. EPRI NP-5769. NRC GL 91-17. IEB 82-02. NRC Bull 89-02. NRC IN 90-68 S1. ASME Section XI, 1989 Edition.

VII E5-4

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~continued~~ from previous page) exchangers. ***(5) Monitoring and Trending:*** Frequent monitoring of component cooling system and ASME Section XI testing schedule should provide for timely detection of leakage or effects of corrosion. Based on plant specifics, water chemistry monitoring may range from few times a week to once a month. 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 related to corrosion or leakage of primary coolant are compared to 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 when acceptable limits are exceeded or leakage is detected. 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:*** Operating plant experience with this AMP indicate timely detection of corrosion in the shut-down cooling system heat exchangers by monitoring for temperature, elevated radiation levels, and corrosion products in the component cooling system.	
Same as for Wear of Item E5.1.2 bolting for piping flange connections.	*Same as for Wear of Item E5.1.2 bolting for piping flange connections.*	No

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION VIIE.5

GALL SECTION	TITLE	ITEM NO	PAGE	COMMENT
VII E5-1		E5.1.2	VII E5-4	Item E5.1.1 is a TLAA. We will capture this item in our activity to identify and describe TLAAs in the Standard Review Plan.
VII E5-2	Shutdown Cooling (Older BWR)	E5.1.1	VII E5-5 VII E5-7 VII E5-15 VII E5-17	Replace text in the Aging management program column to reflect that Primary Water Chemistry and Inservice Inspection for Class 1, 2 and 3 components are the aging management programs. Also, revise the text in the Evaluation and Technical basis column to reference proposed GALL Chapter XI and the discussion of the Primary Water Chemistry and ISI programs.
VII E5-3		E5.2.1	VII E5-13	Replace text in the Aging management program column to reflect that Inservice Inspection for Class 1, 2 and 3 components is the aging management program. Also, revise the text in the Evaluation and Technical basis column to reference proposed GALL Chapter XI and the discussion of the ISI program.
VII E5-4		E5.3.1	VII E5-19	Replace text in the Aging management program column to reflect that Primary Water Chemistry as the aging management program. Also, revise the text in the Evaluation and Technical basis column to reference proposed GALL Chapter XI and the discussion of the Primary Water Chemistry program.

F1. Control Room Area Ventilation System

System, Structures, and Components

The system, structures, and components included in this table comprise the control room area ventilation system which contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, and heating and cooling air handlers.

System Interfaces

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

VII AUXILIARY SYSTEMS

F1. CONTROL ROOM AREA VENTILATION SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F1.1.1 F1.1.2	Duct	Duct Fittings, and Access Doors, Equipment Frames and Housing	Carbon Steel (CS) (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

Plant Specific Aging Management Activity/ Programs required

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~The AMP should rely on routine visual~~ inspection by conducting system walkdowns to obtain early detection of significant degradation of system components, such as ducting, fan housings, damper frames, heat exchanger housing, and other items for evidence of any corrosion, wear, or ~~other indications of degradation~~. Plant Specific Aging Management Activities/Programs	~~*(1) Scope of Program:* The AMP should focus on managing~~ the integrity of all ducts, fittings and equipment frames and housings in the ventilation system used to provide air to the control room area. ***(2) Preventive Actions:*** Periodic plant system walkdowns and visual inspection should be undertaken to assure that the corrosion is not occurring. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected should include evidence of material loss such as holes, pitting and rust buildup. The moisture level should be examined periodically at susceptible locations of components to ensure acceptable levels of moisture in the air throughout the system. Additional parameters should include evidence of tearing of elastomeric flexible collars, excessive wear and/or hardness of elastomeric seals on dampers, and loosening of bolts anchoring equipment. ***(4) Detection of Aging Effects:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm and moist air particularly in areas such as low spots in the duct. Degradation of duct and fittings becomes evident by observation of pitting, rust, degradation of paint and other coatings, and the appearance of small holes. Additional examination techniques should be considered to detect effects of corrosion especially in areas not easily detected from the walkdowns. ***(5) Monitoring and Trending:*** Certain areas not easily inspected due to poor access or other impediments, should be inspected by gaining access through manway or other access doors. The results of inspections should be used to determine the frequency of any future inspections. ***(6) Acceptance Criteria:*** Any appearance of excessive rust, pitting, and buildup of foreign material on the surfaces of the ducts, fittings, and bolting should be reported and evaluated. Appearances of tearing, excessive wear, or other distress of elastomer flexible collars and/or seals should also be reported and evaluated. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions programs, QA procedures, site review and approval processes, 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:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm and moist air particularly in areas such as low spots in the duct. In some cases, the humidity level in the system far exceeded the level (70%) recommended in Regulatory Guide 1.52 [See NRC ~~Information Notice IN 82-43~~].	Yes, no generic AMP

VII F1-1

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F1.1.3 F1.1.4	Duct Delete, Not A TLAA VII F1-4	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degradation From Heating and Radiation	NRC IN 82-43. NRC Reg. Guide 1.52.
F1.1.3 F1.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Attrition	Wear	NRC IN 82-43. NRC Reg. Guide 1.52.
F1.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.
F1.3.1	Piping	Piping and Fittings	CS	Hot or Cold Treated Water	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

VII F1-4

VII AUXILIARY SYSTEMS

F1. ~~CONTROL~~ ROOM AREA VENTILATION SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Same as for General, Microbiologically-~~ *Influenced, Pitting, and Crevice Corrosion for Items F1.1.1 duct, fittings, and access doors, and F1.1.2, equipment frames and housings.* In addition, several properties of elastomers change over time and with exposure to temperature changes and oxygen. Elastomers generally harden as they age, making sealing more difficult. If allowed to proceed, some of the changes in the material may result in tearing of elastomer flexible collars, and/or seals, and in failure to seal the joint tightly. Therefore, a time-limited aging analysis (TLAA) of the elastomer should be performed for the extended ~~period of license renewal.~~	~~*Same as for General,*~~ *Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F1.1.1 duct, fittings, and access doors, and F1.1.2, equipment frames and housings.* In addition, a ~~time-limited~~ aging analysis (TLAA) of the elastomer should be performed for the extended period of ~~license renewal.~~ NOT A TLAA	Yes, TLAA
Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F1.1.1 duct, fittings, and access doors, and F1.1.2, equipment frames and housings.	*Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F1.1.1 duct, fittings, and access doors, and F1.1.2, equipment frames and housings.*	Yes, no generic AMP
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated. VII F1-3 See Chapter XI for an evaluation of the Closed Cooling Water Chemistry Program	Yes, no generic AMP
~~The AMP should~~ rely on routine visual inspection by conducting plant-wide walkdowns to obtain early detection of significant degradation of system components for evidence of any corrosion or other indications of degradation. This inspection should also include ultrasonic thickness ~~measurement at susceptible~~ locations. Closed cooling water Chemistry	~~(1) *Scope of Program:* The AMP should focus on managing~~ the integrity of all piping and fittings in the ventilation system used to ~~provide air~~ to the control room areas. ***(2) Preventive Actions:*** Periodic plant system walkdowns and visual inspection should be undertaken ~~to assure~~ that the corrosion is not occurring. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected should ~~provide for~~ evidence of any corrosion or other indications of degradation. ***(4) Detection of Aging Effects:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm and moist air particularly in areas such as low spots in the piping. Therefore, inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. This inspection should be visual, and ultrasonic thickness measurement at susceptible locations should also be undertaken to assure that significant corrosion is not occurring. ***(5) Monitoring and Trending:*** The results of inspections should be used to determine the frequency of any future inspections. ***(6) Acceptance Criteria:*** Any degradation found in visual inspection and UT measurement should be reported and evaluated. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective ~~actions~~	Yes, no generic AMP

VII AUXILIARY SYSTEMS

F1. CONTROL ROOM AREA VENTILATION SYSTEM

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

VII F1-3

VII AUXILIARY SYSTEMS
F1. CONTROL ROOM AREA VENTILATION SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ programs, QA procedures, site review and approval processes, 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:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm and moist air particularly in areas such as low spots in the piping. In some cases, the humidity level in the system far exceeded the level (70%) recommended in Regulatory Guide 1.52 (See NRC Information Notice IN 82-43).	

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIF.1

GALL SECTION	TITLE	ITEM NO	PAGE	COMMENT
VII F1-1	Aux. Systems Control Room Ventilation	All	VII F1-4 Through 9	Most sections have the statement 'No generic AMP' in the Further Evaluation column. Recommend these sections state 'Plant-specific aging management program/activity' in the Existing Aging Management Program column and 'Plant-specific aging management program/activity required' in the Evaluation and Technical Basis column.
VII F1-3	Aux. Systems Control Room Ventilation	F1.3.1	VII F1-6 and 7	General Corrosion, Crevice Corrosion, Pitting, and MIC are listed as Aging Mechanisms for the interior of Piping. The chemistry program should be the applicable as existing aging management program.
VII F1-4	Aux. Systems Control Room Ventilation	F1.1.3 and F1.1.4	VII F1-6 and 7	For the Elastomer Degradation Aging Mechanism entries, the reference to 'performing a TLAA' is inappropriate. BASIS: A TLAA is an existing calculation or analysis that meets certain specific criteria and that must be dispositioned in one of several acceptable ways for the period of extended operation. Since there is no information presented that suggests the existence of such a calculation, inclusion of any reference to a TLAA in this entry is incorrect and should be removed.

F2. Auxiliary and Radwaste Area Ventilation System

F2.1 Duct

F2.1.1 Duct, Fittings, and Access Doors

F2.1.2 Equipment Frames and Housing

F2.1.3 Flexible Collars between Ducts and Fans

F2.1.4 Seals in Dampers and Doors

F2.2 Air Handler Heating/Cooling

F2.2.1 Heating/Cooling Coils

F2.3 Piping

F2.3.1 Piping and Fittings

F2. Auxiliary and Radwaste Area Ventilation System

System, Structures, and Components

The system, structures, and components included in this table comprise the auxiliary and radwaste areas ventilation system and contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, and heating and cooling air handlers. 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 auxiliary and radwaste area ventilation system are classified as Group B Quality Standards.

System Interfaces

The system that interfaces with the auxiliary and radwaste area ventilation system is the control room area ventilation system (Table VII F1).

VII AUXILIARY SYSTEMS

F2. AUXILIARY AND RADWASTE AREA VENTILATION SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F2.1.1 F2.1.2	Duct	Duct Fittings, and Access Doors, Equipment Frames and Housing	CS (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

6

Plant specific aging management program/activity required

VII AUXILIARY SYSTEMS
F.2 AUXILIARY AND RADWASTE AREA VENTILATION SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~The AMP should rely on routine visual~~ inspection by conducting system walkdowns to obtain early detection of significant degradation of system components, such as ducting, fan housings, damper frames, heat exchanger housing, and other items for evidence of any corrosion, wear, or ~~other indications of degradation~~. Plant Specific Aging Management Activities/Programs	***(1) Scope of Program:*** The AMP should focus on managing the integrity of all ducts, fittings and equipment frames and housings in the ventilation system used to provide air to the auxiliary and radwaste area. ***(2) Preventive Actions:*** Periodic plant system walkdowns and visual inspection should be undertaken to assure that the corrosion is not occurring. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected should include evidence of material loss such as holes, pitting and rust buildup. The moisture level should be examined periodically at susceptible locations of components to ensure acceptable levels of moisture in the air throughout the system. Additional parameters should include evidence of tearing of elastomeric flexible collars, excessive wear ~~and/or~~ hardness of elastomeric ~~seals on~~ dampers, and loosening of bolts anchoring equipment. ***(4) Detection of Aging Effects:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm and moist air particularly in areas such as low spots in the duct. Degradation of duct and fittings becomes evident by observation of pitting, rust, degradation of paint and other coatings, and the appearance of small holes. Additional examination techniques should be considered to detect effects of corrosion especially in areas not easily detected from the walkdowns. ***(5) Monitoring and Trending:*** Certain areas not easily inspected due to poor access or other impediments, should be inspected by gaining access through manway or other access doors. The results of inspections should be used to determine the frequency of any future inspections. ***(6) ~~Acceptance Criteria:~~*** Any appearance ~~of excessive~~ rust, pitting, and buildup of foreign material on the surfaces of the ducts, fittings, and bolting should be reported and evaluated. Appearances of tearing, excessive wear, or other distress of elastomer flexible collars and/or seals should also be reported and evaluated. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions programs, QA procedures, site review and approval processes, 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:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm and moist air particularly in areas such as low spots in the duct. In some cases, the humidity level in the system far exceeded the level (70%) recommended in Regulatory Guide 1.52 (See NRC ~~Information Notice IN 82-43~~).	Yes, no generic AMP

VII F2-6

VII AUXILIARY SYSTEMS
F2. AUXILIARY AND RADWASTE AREA VENTILATION SYSTEM

~~Item~~	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F2.1.3 F2.1.4	Duct Not A TLAA VII F2-5	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degradation From Heating and Radiation	NRC IN 82-43. NRC Reg. Guide 1.52.
F2.1.3 F2.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Attrition	Wear	NRC IN 82-43. NRC Reg. Guide 1.52.
F2.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.
F2.3.1	Piping	Piping and Fittings	Carbon Steel	Hot or Cold Treated Water	Loss of Material	General, Microbiologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F2.1.1 duct, fittings, and access doors, and F2.1.2 equipment frames and housings. In addition, several properties of elastomers change over time and with exposure to temperature changes and oxygen. Elastomers ~~generally~~ harden as they age, making sealing more difficult. If allowed to proceed, some of the changes in the material may result in tearing of elastomer flexible collars, and/or seals, and in failure to seal the joint tightly. Therefore, a time-limited aging analysis (TLAA) of the elastomer should be performed for the extended period of license renewal.	*Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F2.1.1 duct, fittings, and access doors, and F2.1.2 equipment frames and housings.* In addition, a time-limited aging analysis (TLAA) of the elastomer should be performed for the extended period of license renewal. VII F2-5	~~Yes, TLAA~~
Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F2.1.1 duct, fittings, and access doors, and F2.1.2 equipment frames and housings.	*Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F2.1.1 duct, fittings, and access doors, and F2.1.2 equipment frames and housings.*	Yes, no generic AMP
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, no generic AMP
~~The AMP should rely on routine visual~~ inspection by conducting plant-wide walkdowns to obtain early detection of significant degradation of system components for evidence of any corrosion or other indications of degradation. This inspection should also include ultrasonic thickness measurement at susceptible locations. Closed Cooling Water Chemistry Program	~~***(1) Scope of Program:*** The AMP should focus on managing~~ the integrity of all piping and fittings in the ventilation system used to provide air to the auxiliary and radwaste areas. ***(2) Preventive Actions:*** Periodic plant system walkdowns and visual inspection should be undertaken to assure that the corrosion is not occurring. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected should provide for evidence of any corrosion or other indications of degradation. ***(4) Detection of Aging Effects:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm and moist air particularly in areas such as low spots in the piping. Therefore, inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. This inspection should be visual, and ultrasonic thickness measurement at susceptible locations should also be undertaken to assure that significant corrosion is not occurring. ***(5) Monitoring and Trending:*** The results of inspections should be used to determine the frequency of any future inspections. ***(6) Acceptance Criteria:*** Any degradation found in visual ~~inspection and UT measurement should be reported and~~	~~Yes, no generic AMP~~ No

See Chapter XI for an evaluation of the Closed Cooling Water Chemistry Program

VII F2-4

VII AUXILIARY SYSTEMS

F2. AUXILIARY AND RADWASTE AREA VENTILATION SYSTEM

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)~~ evaluated. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions programs, QA procedures, site review and approval processes, 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:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm and moist air particularly in areas such as low spots in the piping. In some cases, the humidity level in the system far exceeded the level (70%) recommended in Regulatory Guide 1.52 (See NRC Information Notice IN 82-43).	

VII
F2-4

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIF.2

GALL SECTION	TITLE	ITEM NO	PAGE	COMMENT
VII F2-1	Aux. Systems Auxiliary and Radwaste Area Ventilation	All	VII F2-4 Through 9	Most sections have the statement 'No generic AMP' in the Further Evaluation column. Recommend these sections state 'Plant-specific aging management program/activity' in the Existing Aging Management Program column and 'Plant-specific aging management program/activity required' in the Evaluation and Technical Basis column.
VII F2-4	Aux. Systems Auxiliary and Radwaste Area Ventilation	F2.3.1	VII F2-6 and 7	General Corrosion, Crevice Corrosion, Pitting, and MIC are listed as Aging Mechanisms for the interior of Piping. The chemistry program should be the applicable as existing AMP. Refer to AMA titled *'Chemistry Program (Closed Cooling).'*
VII F2-5	Aux. Systems Auxiliary and Radwaste Area Ventilation	F2.1.3 and F2.1.4	VII F2-6 and 7	For the Elastomer Degradation Aging Mechanism entries, the reference to 'performing a TLAA' is inappropriate. BASIS: A TLAA is an existing calculation or analysis that meets certain specific criteria and that must be dispositioned in one of several acceptable ways for the period of extended operation. Since there is no information presented that suggests the existence of such a calculation, inclusion of any reference to a TLAA in this entry is incorrect and should be removed.

F3. Engineered Safety Feature Ventilation System (Primary Containment Area)

F3.1 Duct

F3.1.1 Duct, Fittings, and Access Doors

F3.1.2 Equipment Frames and Housing

F3.1.3 Flexible Collars between Ducts and Fans

F3.1.4 Seals in Dampers and Doors

F3.2 Air Handler Heating/Cooling

F3.2.1 Heating/Cooling Coils

F3.3 Piping

F3.3.1 Piping and Fittings

F3. Engineered Safety Feature Ventilation System (Primary Containment Area)

System, Structures, and Components

The system, structures, and components included in this table comprise the primary containment heating and ventilation system which contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, and heating and cooling air handlers. 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 primary containment heating and ventilation system are classified as Group C Quality Standards.

System Interfaces

The system that interfaces with the primary containment heating and ventilation system is the closed cycle cooling water system (Table VII C2).

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F3.1.1 F3.1.2	Duct	Duct Fittings, and Access Doors, Equipment Frames and Housing	CS (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

Plant specific aging management program/activity required

VII AUXILIARY SYSTEMS
F3. PRIMARY CONTAINMENT HEATING AND VENTILATION SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~The AMP should rely on routine visual inspection by conducting plant-wide walkdowns to obtain early detection of significant degradation of system components, such as ducting, fan housings, damper frames, heat exchanger housing, and other items for evidence of any corrosion, wear, or other indications of degradation.~~ Plant Specific aging management program/activity	~~***(1) Scope of Program:*** The AMP should focus on managing the integrity of all ducts, fittings and equipment frames and housings in the ventilation system used to provide air to the primary containment building area. ***(2) Preventive Actions:*** Periodic plant system walkdowns and visual inspection should be undertaken to assure that the corrosion is not occurring. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected should include evidence of material loss such as holes, pitting and rust buildup. The moisture level should be examined periodically at susceptible locations of components to ensure acceptable levels of moisture in the air throughout the system. Additional parameters should include evidence of tearing of elastomeric flexible collars, excessive wear and/or hardness of elastomeric seals on dampers, and loosening of bolts anchoring equipment. ***(4) Detection of Aging Effects:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm, moist air within the containment area, particularly in areas such as low spots in the duct. Degradation of duct and fittings becomes evident by observation of pitting, rust, degradation of paint and other coatings, and the appearance of small holes. Additional examination techniques should be considered to detect effects of corrosion especially in areas not easily detected from the walkdowns. ***(5) Monitoring and Trending:*** Certain areas not easily inspected due to poor access or other impediments, should be inspected by gaining access through manway or other access doors. The results of inspections should be used to determine the frequency of any future inspections. ***(6) Acceptance Criteria:*** Any appearance of excessive rust, pitting, and buildup of foreign material on the surfaces of the ducts, fittings, and bolting should be reported and evaluated. Appearances of tearing, excessive wear, or other distress of elastomer flexible collars and/or seals should also be reported and evaluated. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions programs, QA procedures, site review and approval processes, 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:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm, moist air within the containment area, particularly in areas such as low spots in the duct. In some cases, the humidity level (70%) in the system far exceeded the level recommended in Regulatory Guide 1.52 (See NRC Information Notice IN 82-23).~~	Yes, no generic AMP

VII F3-1

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
F3.1.3 F3.1.4	Duct Delete Item VII F3-5	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degradation From Heating and Radiation	NRC IN 82-43. NRC Reg. Guide 1.52.
F3.1.3 F3.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Attrition	Wear	NRC IN 82-43. NRC Reg. Guide 1.52.
F3.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Micro-biologically -Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.
F3.3.1	Piping	Piping and Fittings	Carbon Steel	Hot or Cold Treated Water	Loss of Material	General, Micro-biologically -Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F3.1.1 duct, fittings, and access doors and F3.1.2 equipment frames and housings. In addition, several properties of elastomers change over time and with exposure to temperature changes and oxygen. Elastomers generally harden as they age, making sealing more difficult. If allowed to proceed, some of the changes in the material may result in tearing of elastomer flexible collars, and/or seals, and in failure to seal the joint tightly. Therefore, a time-limited aging analysis (TLAA) of the elastomer should be performed for the extended period of license renewal.	*Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F3.1.1 duct, fittings, and access doors and F3.1.2 equipment frames and housings.* In addition, a time limited aging analysis (TLAA) of the elastomer should be performed for the extended period of license renewal. VII F3-5	~~Yes, TLAA~~
Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F3.1.1 duct, fittings, and access doors and F3.1.2 equipment frames and housings.	*Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F3.1.1 duct, fittings, and access doors and F3.1.2 equipment frames and housings.*	Yes, no generic AMP
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, no generic AMP
~~The AMP should rely on routine visual~~ inspection by conducting plant-wide walkdowns to obtain early detection of significant degradation of system components for evidence of any corrosion or other indications of degradation. This inspection should also include ultrasonic thickness ~~measurement at susceptible locations~~ons. Closed Cooling Water Chemistry	~~***(1) Scope of Program:*** The AMP should focus on managing~~ the integrity of all piping and fittings in the ventilation system used to provide air to the primary containment area. ***(2) Preventive Actions:*** Periodic plant system walkdowns and visual inspection should be undertaken to assure that the corrosion is not occurring. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected should provide for evidence of any corrosion or other indications of degradation. ***(4) Detection of Aging Effects:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm, moist air within the containment area, particularly in areas such as low spots in the piping. Therefore, inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. This inspection should be visual, and ultrasonic thickness measurement at susceptible locations should also be undertaken to assure that significant corrosion is not occurring. ***(5) Monitoring and Trending:*** The results of inspections should be used to determine the frequency of any future inspections. ***(6) Acceptance Criteria:*** Any degradation ~~found in visual inspection and UT measurement should~~	~~Yes, no~~ generic ~~AMP~~

See Chapter XI for an evaluation of the Closed Cooling Water Chemistry Program

VII F3-4

VII AUXILIARY SYSTEMS

F3. PRIMARY CONTAINMENT HEATING AND VENTILATION SYSTEM

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

VII AUXILIARY SYSTEMS

F3. PRIMARY CONTAINMENT HEATING AND VENTILATION SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from~~ *previous page)* be reported and evaluated. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions programs, QA procedures, site review and approval processes, 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:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm, moist air within the containment area, particularly in areas such as low spots in the piping. In some cases, the humidity level (70%) in the system far exceeded the level recommended in Regulatory Guide 1.52 (See NRC Information Notice IN 82-43).	

VII
F3-4

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIF.3

GALL SECTION	TITLE	ITEM NO.	PAGE	COMMENT
VII F3-1	Aux. Systems ESF Ventilation (Primary Containment Area)	All	VII F3-4 Through 9	Most sections have the statement 'No generic AMP' in the Further Evaluation column. Recommend these sections state 'Plant-specific aging management program/activity' in the Existing Aging Management Program column and 'Plant-specific aging management program/activity required' in the Evaluation and Technical Basis column.
VII F3-4	Aux. Systems ESF Ventilation (Primary Containment Area)	F3.3.1	VII F3-6 and 7	General Corrosion, Crevice Corrosion, Pitting, and MIC are listed as Aging Mechanisms for the interior of Piping. The chemistry program should be the applicable as existing AMP. Refer to AMA titled *'Chemistry Program (Closed Cooling).'*
VII F3-5	Aux. Systems ESF Ventilation (Primary Containment Area)	F3.1.3 and F3.1.4	VII F3-6 and 7	For the Elastomer Degradation Aging Mechanism entries, the reference to 'performing a TLAA' is inappropriate. BASIS: A TLAA is an existing calculation or analysis that meets certain specific criteria and that must be dispositioned in one of several acceptable ways for the period of extended operation. Since there is no information presented that suggests the existence of such a calculation, inclusion of any reference to a TLAA in this entry is incorrect and should be removed.

F4. Diesel Generator Building Ventilation System

F4.1 Duct

F4.1.1 Duct, Fittings, and Access Doors

F4.1.2 Equipment Frames and Housing

F4.1.3 Flexible Collars between Ducts and Fans

F4.1.4 Seals in Dampers and Doors

F4.2 Air Handler Heating/Cooling

F4.2.1 Heating/Cooling Coils

F4.3 Piping

F4.3.1 Piping and Fittings

F4. Diesel Generator Building Ventilation System

System, Structures, and Components

The system, structures, and components included in this table comprise the diesel generator building ventilation system which contain ducts, piping and fitting, equipment frames and housings, flexible collars and seals, and heating and cooling air handlers. 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 diesel generator building ventilation system are classified as Group C Quality Standards.

System Interfaces

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

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F4.1.1 F4.1.2	Duct	Duct Fittings, and Access Doors, Equipment Frames and Housing	CS (Galvanized or Painted) Bolts: Plated CS	Warm, Moist Air	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

Plant specific aging management program/activity required

VII AUXILIARY SYSTEMS
F4. DIESEL GENERATOR BUILDING VENTILATION SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~The AMP should rely on routine visual inspection by conducting system walkdowns to obtain early detection of significant degradation of system components, such as ducting, fan housings, damper frames, heat exchanger housing, and other items for evidence of any corrosion, wear, or other indications of degradation.~~ Plant specific aging management program/activity VII F4-1	~~*(1) Scope of Program:* The AMP should focus on managing the integrity of all ducts, fittings and equipment frames and housings in the ventilation system used to provide air to the diesel generator building area. *(2) Preventive Actions:* Periodic plant system walkdowns and visual inspection should be undertaken to assure that the corrosion is not occurring. *(3) Parameters Monitored/ Inspected:* The parameters inspected should include evidence of material loss such as holes, pitting and rust buildup. The moisture level should be examined periodically at susceptible locations of components to ensure acceptable levels of moisture in the air throughout the system. Additional parameters should include evidence of tearing of elastomeric flexible collars, excessive wear and/or hardness of elastomeric seals on dampers, and loosening of bolts anchoring equipment. *(4) Detection of Aging Effects:* General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm and moist air particularly in areas such as low spots in the duct. Degradation of duct and fittings becomes evident by observation of pitting, rust, degradation of paint and other coatings, and the appearance of small holes. Additional examination techniques should be considered to detect effects of corrosion especially in areas not easily detected from the walkdowns. *(5) Monitoring and Trending:* Certain areas not easily inspected due to poor access or other impediments, should be inspected by gaining access through manway or other access doors. The results of inspections should be used to determine the frequency of any future inspections. *(6) Acceptance Criteria:* Any appearance of excessive rust, pitting, and buildup of foreign material on the surfaces of the ducts, fittings and bolting should be reported and evaluated. Appearances of tearing, excessive wear, or other distress of elastomer flexible collars and/or seals should also be reported and evaluated. *(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:* Site corrective actions programs, QA procedures, site review and approval processes, 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:* General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the duct exposed to the warm and moist air particularly in areas such as low spots in the duct. In some cases, the humidity level in the system far exceeded the level (70%) recommended in Regulatory Guide 1.52 (See NRC Information Notice IN 82-43).~~	Yes, no generic AMP

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
F4.1.3 F4.1.4 Delete VII F4-5	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Hardening and Loss of Strength	Elastomer Degradation From Heating and Radiation	NRC IN 82-43. NRC Reg. Guide 1.52.
F4.1.3 F4.1.4	Duct	Flexible Collars Between Ducts and Fans, Seals in Dampers and Doors	Elastomer (Neoprene)	Warm, Moist Air	Attrition	Wear	NRC IN 82-43. NRC Reg. Guide 1.52.
F4.2.1	Air Handler Heating/ Cooling	Heating/ Cooling Coils	Copper/ Nickel	Warm, Moist Air	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.
F4.3.1	Piping	Piping and Fittings	Carbon Steel	Hot or Cold Treated Water	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	NRC IN 82-43. NRC Reg. Guide 1.52.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F4.1.1 duct, fittings, and access doors and F4.1.2 equipment frames and housings. In addition, several properties of elastomers change over time and with exposure to temperature changes and oxygen. Elastomers generally harden as they age, making sealing more difficult. If allowed to proceed, some of the changes in the material may result in tearing of elastomer flexible collars, and/or seals, and in failure to seal the joint tightly. Therefore, a time-limited aging analysis (TLAA) of the elastomer should be performed for the extended period of license renewal.	*Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F4.1.1 duct, fittings, and access doors and F4.1.2 equipment frames and housings.* In addition, a time-limited aging analysis (TLAA) of the elastomer should be performed for the extended period of license renewal. VII F4-5	Yes, TLAA
Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F4.1.1 duct, fittings, and access doors and F4.1.2 equipment frames and housings.	*Same as for General, Microbiologically-Influenced, Pitting, and Crevice Corrosion for Items F4.1.1 duct, fittings, and access doors and F4.1.2 equipment frames and housings.*	Yes, no generic AMP
Plant-specific aging management program.	Plant-specific aging management program is to be evaluated.	Yes, no generic AMP
~~The AMP should rely on routine visual~~ inspection by conducting plant-wide walkdowns to obtain early detection of significant degradation of system components for evidence of any corrosion or other indications of degradation. This inspection should also include ultrasonic thickness ~~measurement at susceptible locations.~~ Closed Cooling Water Chemistry Program	~~*(1) Scope of Program:* The AMP should focus on managing~~ the integrity of all piping and fittings in the ventilation system used to provide air to the diesel generator building areas. ***(2) Preventive Actions:*** Periodic plant system walkdowns and visual inspection should be undertaken to assure that the corrosion is not occurring. ***(3) Parameters Monitored/ Inspected:*** The parameters inspected should provide for evidence of any corrosion or other indications of degradation. ***(4) Detection of Aging Effects:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm and moist air particularly in areas such as low spots in the piping. Therefore, inspection of representative components and susceptible locations should be undertaken to provide additional assurance that significant corrosion is not occurring. This inspection should be visual, and ultrasonic thickness measurement at susceptible locations should also be undertaken to assure that significant corrosion is not occurring. ***(5) Monitoring and Trending:*** The results of inspections should be used to determine the frequency of any future inspections. ~~*(6) Acceptance Criteria:* Any degradation found in visual~~	~~Yes, no generic AMP~~ NO

See Chapter XI for an evaluation of the Closed Cooling Water Chemistry Program

VII F4-4

VII AUXILIARY SYSTEMS

F4. DIESEL GENERATOR BUILDING VENTILATION SYSTEM

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

VII AUXILIARY SYSTEMS

F4. DIESEL GENERATOR BUILDING VENTILATION SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) inspection and UT measurement should be reported and evaluated. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions programs, QA procedures, site review and approval processes, 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:*** General corrosion, microbiologically-influenced corrosion, crevice corrosion, and pitting corrosion may occur in sections of the piping exposed to the warm and moist air particularly in areas such as low spots in the piping. In some cases, the humidity level in the system far exceeded the level (70%) recommended in Regulatory Guide 1.52 (See NRC Information Notice IN 82-43).	

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F4-4

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIF.4

GALL SECTION	TITLE	ITEM NO	PAGE	COMMENT
VII F4-1	Aux. Systems Diesel Generator Building Ventilation	All	VII F4-4 Through 9	Most sections have the statement 'No generic AMP' in the Further Evaluation column. Recommend these sections state 'Plant-specific aging management program/activity' in the Existing Aging Management Program column and 'Plant-specific aging management program/activity required' in the Evaluation and Technical Basis column.
VII F4-4	Aux. Systems Diesel Generator Building Ventilation	F4.3.1	VII F4-6 and 7	General Corrosion, Crevice Corrosion, Pitting, and MIC are listed as Aging Mechanisms for the interior of Piping. The chemistry program should be the applicable as existing aging management program.
VII F4-5	Aux. Systems Diesel Generator Building Ventilation	F4.1.3 and F4.1.4	VII F4-6 and 7	For the Elastomer Degradation Aging Mechanism entries, the reference to 'performing a TLAA' is inappropriate. BASIS: A TLAA is an existing calculation or analysis that meets certain specific criteria and that must be dispositioned in one of several acceptable ways for the period of extended operation. Since there is no information presented that suggests the existence of such a calculation, inclusion of any reference to a TLAA in this entry is incorrect and should be removed.

G. Fire Protection

G.1 Intake Structure

G.1.1 Fire Barrier Penetration Seals

G.1.2 Fire Barrier Walls, Ceiling, and Floors

G.1.3 Fire Rated Doors

G.2 Turbine Building

G.2.1 Fire Barrier Penetration Seals

G.2.2 Fire Barrier Walls, Ceiling, and Floors

G.2.3 Fire Rated Doors

G.3 Auxiliary Building

G.3.1 Fire Barrier Penetration Seals

G.3.2 Fire Barrier Walls, Ceiling, and Floors

G.3.3 Fire Rated Doors

G.4 Diesel Generator Building

G.4.1 Fire Barrier Penetration Seals

G.4.2 Fire Barrier Walls, Ceiling, and Floors

G.4.3 Fire Rated Doors

G.5 Primary Containment

VII
G-1

G.5.1 Fire Barrier Walls, Ceiling, and Floors

G.5.2 Fire Rated Doors

G.6 ~~High Pressure Service Water System~~ Water Based Fire Protection System

G.6.1 Piping and Fittings

G.6.2 Filter, Fire Hydrants, Mulsifier, Pump Casing, Sprinkler, Strainer, and Valve Bodies

G.7 Reactor Coolant Pump Oil Collect System

G.7.1 Tank

G.7.2 Piping, Tubing, Valve Bodies

G.8 Diesel Fire System

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

G. Fire Protection

System, Structures, and Components

The system, structure, and components included in this table comprise the fire protection system for both boiling water reactors (BWRs) and pressurized water reactors (PWRs) and consist of several Class 1 structures and mechanical systems. The Class 1 structures include intake structure, turbine building, auxiliary building, diesel generator building, and primary containment, and structural components include fire barrier wall, ceiling, floor, fire door, and penetration seal. Mechanical systems include high pressure service water system, reactor coolant pump oil collect system, and diesel fire system, and mechanical components include piping and fittings, filter, fire hydrant, mulsifyer, pump, valves, sprinkler, and strainer. All the mechanical components are classified as Group C Quality Standards.

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

System Interfaces

The systems that interface with the fire protection system include various Class 1 structures and component supports (Chapter III), closed cycle cooling water system (Table VII C2) and the Diesel Fuel Oil System (Table VII H1).

VII G-2

VII AUXILIARY SYSTEMS
G. FIRE PROTECTION

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.1.1	Intake Structure	Fire Barrier Penetration Seals (for Piping, Electrical Conduit, Cable Tray, Heating, Ventilation, Air Condition, and Expansion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture NOT A TLAA	Increased Hardness and Shrinkage	Weathering	10 CFR Part 50, Appendix R.
G.1.2	Intake Structure	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	10 CFR Part 50, Appendix R.

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NOT A TLAA

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
As part of the plant fire protection program mandated by 10 CFR Part 50, Appendix R, the fire barrier inspection program requires periodic visual inspection of fire barrier penetration seals for signs of seal degradation such as cracking, separation from walls or components, rupture or puncture of seal, to ensure that the intended function of the fire barrier penetration is maintained. The inspection should be conducted once every 18 months. Corrective actions should be initiated as necessary. In addition, several properties of sealant change over time due to weathering. Sealants generally harden as they age, making sealing more difficult. If allowed to proceed, some of the changes in the material may result in failure to seal the joint tightly. Therefore, time-limited aging analysis (TLAA) of the sealant should be performed for the period of license renewal.	***(1) Scope of Program:*** The program is focused on managing the effects of weathering on the intended function of the penetration seals of piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint that perform fire barrier function. ***(2) Preventive Actions:*** Penetration seal provides a fire barrier to confine or retard a fire from spreading by protecting the safety-related systems and components from heat and smoke exposure. Periodic inspection is performed. Degraded penetration seal is repaired or replaced. ***(3) Parameters Monitored/Inspected:*** The visual inspection examines the signs of degradation such as cracking, separation from walls and component, separation of layers of material, rupture and puncture of seal which are directly caused by increased hardness and shrinkage of seal material due to weathering. ***(4) Detection of Aging Effects:*** Visual inspection should detect cracking, separation from walls and component, rupture and puncture of seal. Visual inspection and periodic inspection performed at least once every 18 months should ensure timely detection of increased hardness and shrinkage of the penetration seal before the loss of the component intended function. ***(5) Monitoring and Trending:*** The effects of weathering are detectable by visual inspection and, based on operating experience, inspection performed at least once every 18 months that degradation of the fire barrier penetration seal is detected prior to loss of the intended function. ***(6) Acceptance Criteria:*** No visual indications of cracking, separation from walls and components, or separation of layers of material, or rupture and puncture of seal. However, properties of sealant change over time due to weathering; TLAA of the sealant should be performed to assure continued service. ***(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:*** Operating experience with this AMP has shown that failure of penetration seal due to weathering is insignificant.	Yes TLAA
As part of the plant fire protection program mandated by 10 CFR Part 50, the fire barrier inspection program requires periodic visual inspection of fire barrier walls, ceilings, and floors, for signs of degradation such as concrete cracking, spalling, and corrosion of reinforcement, to ensure that the intended function of the fire barriers is maintained. The inspection should be conducted once every 18 months. Corrective actions are initiated as necessary.	***(1) Scope of Program:*** The program is focused on managing the aging effects on the intended function of the fire rated walls, ceilings, and floors that perform fire barrier function. ***(2) Preventive Actions:*** Fire rated walls, ceilings, and floors provide fire barriers to confine or retard a fire from spreading by protecting the safety-related systems and components from flame and heat exposure. Visual inspection is conducted at least every 18 months. Corrective actions are initiated as necessary. ***(3) Parameters Monitored/Inspected:*** The AMP requires visual inspection of the fire rated walls, ceilings, and floors for cracking, spalling, and loss of material which are signs of degradation of the fire rated structural components caused by	No

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Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.1.2	Intake Structure	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	10 CFR Part 50, Appendix R.
G.1.3	Intake Structure	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	10 CFR Part 50, Appendix R.

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G. FIRE PROTECTION

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

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G. FIRE PROTECTION

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.2.1	Turbine Building	Fire Barrier Penetration Seals (for Piping, Electrical Conduit, Cable Tray, Heating, Ventilation, Air Condition, and Expansion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture	Increased Hardness and Shrinkage	Weathering NOT A TLAA	10 CFR Part 50, Appendix R.
G.2.2	Turbine Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	10 CFR Part 50, Appendix R.
G.2.2	Turbine Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	10 CFR Part 50, Appendix R.
G.2.3	Turbine Building	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	10 CFR Part 50, Appendix R.
G.3.1	Auxiliary Building	Fire Barrier Penetration Seals (for Piping, Electrical Conduit, Cable Tray, Heating, Ventilation, Air Condition, and Expansion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture	Increased Hardness and Shrinkage	Weathering NOT A TLAA	10 CFR Part 50, Appendix R.
G.3.2	Auxiliary Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	10 CFR Part 50, Appendix R.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Continued from previous page) administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Fire doors have experienced wear of the hinges and handles. Operating experience with this AMP has shown that degradation of fire door is insignificant.	
Same as the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.	*Same as the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.* NOT A TLAA	Yes TLAA
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No
Same as the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint. NOT A TLAA	*Same as the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*	Yes TLAA
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No

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Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.3.2	Auxiliary Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	10 CFR Part 50, Appendix R.
G.3.3	Auxiliary Building	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	10 CFR Part 50, Appendix R.
G.4.1	Diesel Generator Building	Fire Barrier Penetration Seals (for Piping, Electrical Conduit, Cable Tray, Heating, Ventilation, Air Condition, and Expansion Joint)	Sealant	Indoors: Air Outdoors: Sun, Weather, Humidity, and Moisture	Increased Hardness and Shrinkage NOT A TLAA	Weathering	10 CFR Part 50, Appendix R.
G.4.2	Diesel Generator Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Concrete Cracking and Spalling	Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates	10 CFR Part 50, Appendix R.
G.4.2	Diesel Generator Building	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor and Outdoor Environ-ments	Loss of Material	Corrosion of Embedded Steel	10 CFR Part 50, Appendix R.
G.4.3	Diesel Generator Building	Fire Rated Doors	Steel	Indoor and Outdoor Environ-ments	Loss of Material	Wear	10 CFR Part 50, Appendix R.
G.5.1	Primary Containment	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor	Concrete Cracking and Spalling	Aggressive Chemical Attack, and Reaction with Aggregates	10 CFR Part 50, Appendix R.
G.5.1	Primary Containment	Fire Barrier Walls, Ceiling, and Floors	Concrete and Reinforce-ment	Indoor	Loss of Material	Corrosion of Embedded Steel	10 CFR Part 50, Appendix R.
G.5.2	Primary Containment	Fire Rated Doors	Steel	Indoor	Loss of Material	Wear	10 CFR Part 50, Appendix R.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No
Same as the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray,-heating, ventilation, air condition, and expansion joint. NOT A TLAA	*Same as the effects of Weathering of Item G.1.1 fire barrier penetration seals for piping, electrical conduit, cable tray, heating, ventilation, air condition, and expansion joint.*	Yes TLAA
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.	*Same as for Freeze-thaw, Aggressive Chemical Attack, and Reaction with Aggregates of Item G.1.2 fire barrier walls, ceiling, and floors.*	No
Same as for Wear of Item G.1.3 fire barrier doors.	*Same as for Wear of Item G.1.3 fire barrier doors.*	No

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Item	Structure and ~~Component~~	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.6.1	~~High Pressure Service Water System~~ Water Based Fire Protection System VII G-1	Piping and Fittings	Carbon Steel (CS), Cast Iron, and Stainless Steel (SS)	Raw Water	Loss of Material	General, Microbiologically-Induced, Pitting, and Crevice Corrosion	IN 94-03.
G.6.1	~~High Pressure Service Water System~~ Water Based Fire Protection System	Piping and Fittings	CS, Cast Iron, SS	Raw Water	Loss of Material	Galvanic Corrosion	IN 94-03.

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See Chapter XI for an evaluation of Fire Water System Aging Management Activities

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Volumetric examination such as~~ ultrasonic testing is conducted every 5 to 10 years at the most susceptible locations, e.g., stagnant or low flow areas, to examine whether loss of material due to corrosion has occurred. Repair or replacement is initiated if loss of material exceeds the acceptance ~~criteria.~~ Fire Water System Program	~~*(1) Scope of Program:* The program focuses on managing~~ loss of material due to corrosion on the carbon steel and cast iron steel components exposed to raw water. ***(2) Preventive Actions:*** Volumetric examination is conducted at the most susceptible locations for the evidence of loss of material due to corrosion. Repair and replacement of the component is initiated as necessary. ***(3) Parameters Monitored/Inspected:*** Loss of Material would reduce component wall thickness. The parameter monitored in the AMP is the reduction of wall thickness at the most susceptible locations such as stagnant or low fluid flow region. ***(4) Detection of Aging Effects:*** Ultrasonic thickness measurement is an effective method to ensure that the effects of corrosion have not occurred and the component intended function is maintained. ***(5) Monitoring and Trending:*** The inspection period is usually between five to ten years considering the slow process of corrosion and operating experience. The results of inspection are used to dictate the frequency of future inspection. ***(6) Acceptance Criteria:*** The measured wall thickness should exceed the minimum required wall thickness at all inspection locations. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** No significant corrosion-related problem is reported for the high-pressure service water system. Inspection of the components with 20 years of service has shown minimal or no loss of material at all of the sensitive locations. No repairs or replacements have been initiated based on the inspection results. NRC performed service water system operational performance inspection and the results are discussed in Information Notice 94-03.	No
~~A walkdown visual inspection and a one-time volumetric examination such as ultrasonic testing should be conducted before the license renewal application for a carbon steel stainless steel couplings (i. e. locations where carbon steel contacts with stainless steel) located at the most susceptible locations (e.g., stagnant or~~	~~*(1) Scope of Program:* The program should focus on~~ managing loss of material due to galvanic corrosion on the carbon steel component contacting with the stainless steel component. ***(2) Preventive Actions:*** Volumetric test, such as ultrasonic testing, should be used to determine whether significant loss of material due to galvanic corrosion has occurred. Repair and replacement should be ~~initiated as necessary. *(3) Parameters*~~	Yes, no generic AMP

Plant Specific Aging Management Activities/Programs

Plant Specific Aging Management Activity/Program required

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G. FIRE PROTECTION

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.6.1	High Pressure Service Water System	Piping and Fittings	CS, Cast Iron, SS	Raw Water	Buildup of Deposit	Biofouling	IN 94-03.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~(continued from previous page)~~ low flow areas) to examine whether loss of material due to galvanic corrosion has occurred. An engineering analysis should be conducted if unacceptable loss of material due to galvanic corrosion is found. Corrective actions should be initiated if necessary. VII G-3	~~(continued from previous page)~~ ***Monitored/Inspected*** The AMP should utilize volumetric examination such as ultrasonic testing to detect reduction of wall thickness at the worst locations such as carbon steel-stainless steel coupling located at stagnant or low fluid flow regions or the lower portion of the system. ***(4) Detection of Aging Effects:*** Ultrasonic testing is an effective method to detect loss of material to ensure that the intended function of the component is maintained. ***(5) Monitoring and Trending:*** One time inspection should be conducted before the license renewal application. If loss of material due to galvanic corrosion is detected, the results of inspection and component analysis should be used to dictate the frequency of future inspection. ***(6) Acceptance Criteria:*** No unacceptable indication of loss of material due to galvanic corrosion. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** No significant problem due to loss of material by galvanic corrosion has been reported for the high-pressure service water system. NRC performed a service water system operational performance inspection and the results are ~~discussed in Information Notice 94-03.~~	
Periodic system performance test and flush test are conducted to ensure no fouling has occurred in the system. Corrective actions such as cleaning are initiated if necessary.	***(1) Scope of Program:*** The program focuses on managing buildup of deposit in the component due to fouling by raw water. ***(2) Preventive Actions:*** Periodic full flow flush test and system performance test prevent buildup of deposit in the component. ***(3) Parameters Monitored/Inspected:*** The AMP monitors the performance by full flow and system performance tests. If fouling occurs in the system, it would degrade the system performance. ***(4) Detection of Aging Effects:*** Periodic system performance test and flush test are effective methods to ensure that the effects of fouling have not occurred and the intended functions are maintained. ***(5) Monitoring and Trending:*** Periodic system performance and full flow flush tests should provide timely detection of fouling and provide trending data. ***(6) Acceptance Criteria:*** No indications of buildup of deposit in the component. ***(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:*** Full flow performance test has resulted in cleaning of sprinkler heads. NRC performed a service water system operational performance inspection and the results are discussed in Information Notice 94-03; applicants should review this information for applicability to their facilities and consider actions as appropriate.	No

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G. FIRE PROTECTION

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
G.6.2	High Pressure Service Water System	Filter, Fire Hydrant, Mulsifyer, Pump Casing, Sprinkler, Strainer, and Valve Bodies	CS, Cast Iron, Bronze, Copper, SS	Raw Water	Loss of Material	General, Microbiologically-Induced, Pitting, and Crevice Corrosion	IN 94-03.
G.6.2	High Pressure Service Water System	Filter, Fire Hydrant, Mulsifyer, Pump Casing, Sprinkler, Strainer, and Valve Bodies	CS Cast Iron	Raw Water	Loss of Material	Galvanic Corrosion	IN 94-03.
G.6.2	High Pressure Service Water System	Filter, Fire Hydrant, Mulsifyer, Pump Casing, Sprinkler, Strainer, and Valve Bodies	CS, Cast Iron, Bronze, SS	Raw Water	Buildup of Deposit	Biofouling	IN 94-03.
G.7.1	Reactor Coolant Pump Oil Collect System	Tank	CS	Lubricating Oil	Loss of Material	General, Galvanic, Pitting, and Crevice Corrosion	10 CFR Part 50, Appendix R. IN 94-58.
G.7.2	Reactor Coolant Pump Oil Collect System	Piping, Tubing, Valve Bodies	Piping and Valve Bodies: CS; Tubing: Copper, Brass	Lubricating Oil	Loss of Material	General, Galvanic, Pitting, and Crevice Corrosion	10 CFR Part 50, Appendix R.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as the effect of General, Microbiologically-Induced, Pitting, and Crevice Corrosion on Item G.6.1 high-pressure service water system piping and fittings.	*Same as the effect of General, Microbiologically-Induced, Pitting, and Crevice Corrosion on Item G.6.1 high-pressure service water system piping and fittings.*	No
Same as the effect of Galvanic Corrosion on Item G.6.1 high-pressure service water system piping and fittings.	*Same as the effect of Galvanic Corrosion on Item G.6.1 high-pressure service water system piping and fittings.*	Yes, no generic AMP
Same as the effect of Biofouling on Item G.6.1 high-pressure service water system piping and fittings.	*Same as the effect of Biofouling on Item G.6.1 high-pressure service water system piping and fittings.*	No
As part of the plant fire protection program mandated by 10 CFR Part 50, Appendix R, a one-time visual inspection and volumetric examination should be conducted of the lower portion of a sample component with the potential to be exposed to oil and water. Engineering analysis should be carried out to determine the proper corrective actions if the measured wall thickness is below the acceptance criteria.	***(1) Scope of Program:*** The program should utilize visual and volumetric examinations to manage loss of material due to corrosion on the intended function of the system. ***(2) Preventive Actions:*** Verification of the structural integrity by timely inspection and corrective actions prevent corrosion of the component. ***(3) Parameters Monitored/Inspected:*** Loss of Material would reduce component wall thickness. The AMP should monitor the wall thickness of the lower portion of the component where contaminant water is expected to accumulate. ***(4) Detection of Aging Effects:*** Aging degradation of the component can not occur without wall thinning; timely inspection assures detection of loss of material before the loss of the intended function of the component. ***(5) Monitoring and Trending:*** Visual inspection and volumetric inspection should be used to ensure that the effects of corrosion have not occurred and intended functions of the component are maintained. ***(6) Acceptance Criteria:*** The measured wall thickness should exceed the required minimum wall thickness determined by engineering analysis. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented 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 corrosion-related problem has been reported for this component. IN 94-58, "Reactor Coolant Pump Lube Oil Fire" reported that a crack in a 1 inch diameter PVC coupling in the pump oil lube system caused oil leak and subsequent fire.	Yes, no generic AMP
Same as for General, Galvanic, Pitting, and Crevice Corrosion of Item G.7.1 reactor coolant pump oil collect tank.	*Same as for General, Galvanic, Pitting, and Crevice Corrosion of Item G.7.1 reactor coolant pump oil collect tank.*	Yes, no generic AMP

VII AUXILIARY SYSTEMS

G. FIRE PROTECTION

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
G.8.1	Diesel Fire System	Diesel-Driven Fire Pump and Fuel Oil Supply Line	CS	Fuel Oil	Loss of Material	General, Galvanic, Pitting, and Crevice Corrosion	10 CFR Part 50, Appendix R.

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G. FIRE PROTECTION

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
As part of the plant fire protection program required by 10 CFR Part 50, Appendix R, the diesel-driven fire pump is periodically tested to ensure that the fire pump can perform the intended function. Corrective actions are initiated as necessary.	***(1) Scope of Program:*** The program is focused on managing the effects of general corrosion on the intended function of the diesel fire pump. ***(2) Preventive Actions:*** Periodic testing, such as flow and discharge test, sequential starting capability test, and controller function test are performed on diesel fire pump to ensure that the system can perform the intended function. ***(3) Parameters Monitored/Inspected:*** The diesel fire pump is under observation during the performance tests for detecting any degradation of the fuel supply line. ***(4) Detection of Aging Effects:*** The periodic performance tests should detect degradation in the fuel oil supply lines before a loss of the intended function can occur. ***(5) Monitoring and Trending:*** The performance of fire pump is monitored during the periodic tests to detect any degradation in the system. Periodic tests provide data for trending. ***(6) Acceptance Criteria:*** No corrosion is allowed in the fuel supply line. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** No corrosion-related problem has been reported for the component.	No

GALL REPORT-MECHANICAL DISCIPLINE COMMENTS
SECTION VIIG

GALL SECTION	TITLE	ITEM NO.	PAGE	COMMENT
VII G-1	Fire Protection	Table of Contents	VIIG-1 VII G-12	Change title of Subsection VIIG.6 to "Water Based Fire Protection System" BASIS: The reference to High Pressure Service Water system in the tables, Table of Contents, and description page should be deleted. The High Pressure Service Water System is not necessarily a Fire Protection system.
VII G-2	Fire Protection	G.1.1	VII G-4	Fire Barrier Seals are not Time Limited Aging Analyses. BASIS: Penetration seals do not meet the criteria of a TLAA, specifically the criterion that sates "Involve time-limited assumptions defined by the current operating term, for example, 40 years."
VII G-3	Fire Protection	G.6.1	VII G-12	Item G.6.1 has the statement 'No generic AMP' in the Further Evaluation column. Recommend this section state 'Plant-specific aging management program/activity' in the Existing Aging Management Program column and 'Plant-specific aging management program/activity required' in the Evaluation and Technical Basis column.
VII G-4	Fire Protection	G.6.1 for loss of material aging effect	VIIG-13	The volumetric exam discussed on page VII G-13 in the Existing Aging Management Program column is not relevant to the referenced program. BASIS: This appears to be a discussion of Flow Accelerated Corrosion aging management. Replace existing text with "Fire Water System Program" Also, replace the "Evaluation and Technical Basis" information with "See Chapter XI for an evaluation of Fire Water System Aging Management Activities."

H1. Diesel Fuel Oil System

H1.1 Piping

H1.1.1 Aboveground Pipe and Fittings

H1.1.2 Underground Pipe and Fittings

H1.2 Valves

H1.2.1 Body and Bonnet

H1.2.2 Closure Bolting

H1.3 Pump

H1.3.1 Casing

H1.3.2 Closure Bolting

H1.4 Tank

H1.4.1 Tank Internal Surfaces

H1.4.2 Tank External Surfaces

H1.4.3 Caulking and Sealant

H1. Diesel Fuel Oil System

System, Structures, and Components

The system, structures, and components included in this table comprise the diesel fuel oil system and consist of above ground and underground piping, valves, pump, and tank. 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 diesel fuel oil system are classified as Group C Quality Standards.

System Interfaces

The system that interfaces with the diesel fuel oil system is the emergency diesel generator system (Table VII H2).

VII AUXILIARY SYSTEMS
H1. DIESEL FUEL OIL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H1.1.1	Piping	Aboveground Piping and Fittings	Carbon Steel	Sun, Weather, Humidity and Moisture	Loss of Material	General ~~Corrosion, Coating Degradation~~ VII H-1	*Operating Experience* GL 98-04
H1.1.1	Piping	Aboveground Piping and Fittings	Carbon Steel	Sun, Weather, Humidity and Moisture	Local Loss of Material	Pitting Corrosion and Crevice Corrosion, Coating, Degradation	*Operating Experience* GL 98-04
H1.1.2	Piping	Underground Piping and Fittings	Carbon Steel	Soil	Loss of Material	General Corrosion, Galvanic Corrosion and Micro-biologically -Influenced Corrosion	Plant Technical Specifications.

VII H-2

metal degradation during each refueling outage

metal

VII AUXILIARY SYSTEMS
H1. DIESEL FUEL OIL SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
The AMP should consist of a combination of plant system walkdowns and maintenance procedures. The plant system walkdown guidelines should require visual inspection for ~~degraded paint, before, during, and after each outage~~, and reporting the walkdown results. When ~~coating~~ metal degradation is found, the plant maintenance procedures ~~for paint and protective coating~~ and the QA procedures, should require a review and evaluation of the walkdown findings. Corrective actions should be initiated as necessary.	***(1) Scope of Program:*** The program should focus on managing the effects of general corrosion on the intended function of the component. Plant walkdowns should cover entire surface of the component. ***(2) Preventive Actions:*** Paint or coating should prevent or mitigate corrosion by protecting the external surfaces of the component from environmental exposure. ***(3) Parameters Monitored/Inspected:*** The AMP should utilize plant system walkdowns to monitor ~~coating~~ metal degradation~~, which is a condition directly related to potential loss of materials.~~ ***(4) Detection of Aging Effects:*** Degradation of the exterior carbon steel surfaces cannot occur without degradation of paint or coating; inspecting and confirming that the paint or coating is intact is an effective method to ensure that effects of corrosion on external surfaces of the component has not occurred and intended functions are maintained. ***(5) Monitoring and Trending:*** The effects of corrosion are detectable by visual techniques and, based on operating experience, plant system walkdown during each outage provide for timely detection of aging effects. ***(6) Acceptance Criteria:*** Any ~~coating~~ metal degradation should be reported and should require further evaluation. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls should be implemented in accordance with Appendix B to 10 CFR Part 50 requirements and should continue to be adequate for license renewal. ***(10) Operating Experience:*** Coating degradation, such as flaking and peeling, has occurred ~~in~~ the safety ~~related systems~~ and structures ~~(NRC Information Notice 98-04).~~	Yes, no generic AMP
Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.	*Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.*	Yes, no generic AMP
The external surfaces of the diesel fuel oil underground piping and fittings are protected, per standard industry practice, with external coating and wrapping and a cathodic protection system. Other suitable means may be used to monitor the condition of underground piping.	***(1) Scope of Program:*** The program relies on preventive measures such as coating, wrapping, and cathodic protection, for managing the effects of corrosion on the intended function of underground piping for diesel fuel oil 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:*** If methods other than coating and cathodic protection are used, these methods must be described. The effectiveness of the coatings	Yes, Elements 3 thru 6 should be further evaluated

VII AUXILIARY SYSTEMS
H1. DIESEL FUEL OIL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H1.1.2	Piping	Underground Piping and Fittings	Carbon Steel	Soil	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	Plant Technical Specifications.
H1.1.2	Piping	Underground Piping and Fittings	Carbon Steel	Soil	~~Corrosion Product Buildup~~ Local loss of material	Micro-biologically-Influenced Corrosion	Plant Technical Specifications.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
VII H1-5	*(continued from previous page)* and cathodic protection system, per standard industry practice, is measured by measuring coating conductance, by pipe-to-soil potential surveys, by conducting bell hole examinations to visual examine the condition of the coating. Coating and wrapping, however, can degrade with ~~time and corrosion may occur.~~ Also, cathodic protection requires periodic monitoring and maintenance to ensure that it is functioning properly. ~~The AMP should include inspection of a sample of the buried piping to ensure that coating and wrapping are intact and corrosion is adequately managed. Also, a monitoring maintenance program should be implemented to ensure that cathodic protection is functioning properly.~~ ***(4) Detection of Aging Effects:*** An increase in coating conductance or the indication that certain portions of the pipes are not adequately protected indicates coating degradation. ~~Inspecting a sample of the buried pipe and confirming that the paint or coating is intact is an effective method to ensure that effects of corrosion on external surfaces of the pipe has not occurred and intended functions are maintained.~~ ***(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 should provide for timely detection of aging effects.~~ ***(6) Acceptance Criteria:*** In accordance with accepted industry ~~practice, the~~ assessment of ~~the condition of the~~ coating and cathodic protection system measurements should be conducted on an annual basis. Also, monitoring the coating conductance verse time or current requirements verse time gives an indication of the condition of the coating and cathodic protection system. ***(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 diesel fuel oil underground pipings for ≈20 years of operation has shown no aging degradation.	
Same as for General, Galvanic corrosion, and Microbiologically-Influenced Corrosion of Item H1.1.2 Underground Piping and Fittings.	*Same as for General, Galvanic corrosion, and Microbiologically-Influenced Corrosion of Item H1.1.2 Underground Piping and Fittings.*	Yes, Elements 3 thru 6 should be further evaluated
~~*Same as for General, Galvanic corrosion, and Microbiologically-Influenced Corrosion of Item H1.1.2 Underground Piping and Fittings.*~~	~~*Same as for General, Galvanic corrosion, and Microbiologically-Influenced Corrosion of Item H1.1.2 Underground Piping and Fittings.*~~	Yes, Elements 3 ~~thru 6~~ should be further evaluated

VII H1-1

VII AUXILIARY SYSTEMS

H1. DIESEL FUEL OIL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H1.2.1, H1.2.2	Valves	Body & Bonnet, Closure Bolting	Carbon Steel or Alloy Steel	Sun, Weather, Humidity and Moisture	Loss of Material	General Corrosion, ~~Coating Degradation~~	*Operating Experience* GL 98-04.
H1.2.1, H1.2.2	Valves	Body & Bonnet, Closure Bolting	Carbon Steel or Alloy Steel	Sun, Weather, Humidity and Moisture	Local Loss of Material	Pitting and Crevice Corrosion, ~~Coating Degradation~~	*Operating Experience* GL 98-04.
H1.3.1, H1.3.2	Pump	Casing, Closure Bolting	Carbon Steel or Alloy Steel	Sun, Weather, Humidity and Moisture	Loss of Material	General Corrosion, ~~Coating Degradation~~	*Operating Experience* GL 98-04.
H1.3.1, H1.3.2	Pump	Casing, Closure Bolting	Carbon Steel or Alloy Steel	Sun, Weather, Humidity and Moisture	Local Loss of Material	Pitting and Crevice Corrosion, ~~Coating Degradation~~	*Operating Experience* GL 98-04.
H1.4.1	Tank	Internal Surfaces	Carbon Steel	Fuel Oil, ~~Water~~	Loss of Material	General Corrosion and Micro-biologically -Influenced Corrosion	ASTM D 270. ASTM D 975. ASTM D 2276. Plant Technical Specifications.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.	*Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.*	Yes, no generic AMP
Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.	*Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.*	Yes, no generic AMP
Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.	*Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.*	Yes, no generic AMP
Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.	*Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.*	Yes, no generic AMP
~~The AMP consists of a combination of~~ surveillance and maintenance procedures. The tank internal surfaces are coated with protective coating to prevent the exposure of carbon steel tank surfaces to fuel oil contaminated with water, bacteria and fungal; and the quality of fuel oil is controlled and maintained in accordance with ASTM specifications D 270, "Standard Method of Sampling Petroleum and Petroleum Products," D 975, "Standard Specification for Diesel Fuel Oils," and D 2276, "Standard Test Method for Particular Contamination in Aviation Fuel." Also, because water collects on the bottom of the tank and may cause corrosion, water is periodically drained. If excessive water is found, corrective actions are taken to prevent recurrence. Additionally, new fuel oil deliveries are treated with corrosion inhibitors and a biocide and sampled ~~and analyzed for water content.~~ Fuel Oil Chemistry	~~*(1) Scope of Program:*~~ The program is focused on ~~managing~~ the conditions that cause general and microbiologically-induced corrosion of the tank internal surfaces, i.e., the program manages the potential of the tank internal surfaces to be exposed to fuel oil contaminated with water, biologics and fungal. ***(2) Preventive Actions:*** Coatings prevent or mitigate corrosion by protecting the internal surfaces of the tank from contacting with water, biologics, and fungal. Periodic draining of water collected at bottom of the tank minimizes the amount of water and the length of contact time. Compliance with ASTM standards D 270 and D 975 and addition of corrosion inhibitors and biocides to new fuel oil, provide adequate measures to control and maintain the standards for diesel fuel oils. ***(3) Parameters Monitored/Inspected:*** The AMP monitors fuel oil standards, and the water, biological, and fungal levels in the fuel oil, which cause loss of material of the tank internal surfaces. ASTM standard D 270 defines fuel oil specifications for viscosity, percent water and sediment, particulate contamination, and biologics, and requires multilevel sampling and analysis of fuel oil to detect the presence of water, biologic and fungal, which cause corrosion of tank internal surfaces. ASTM standard D 2276 provides guidance to quantify insoluble particulate contamination in diesel fuel. ***(4) Detection of Aging Effects:*** Aging degradation of the diesel fuel oil tank can not occur without exposure of the tank internal surfaces to contaminants in the fuel oil, such as water, biologics, and fungal. Although compliance with diesel fuel oil standards and periodic multilevel sampling provide assurance that fuel oil contaminants are below acceptable levels, the AMP does not ensure that coating degradation and exposure of tank internal surfaces to	~~Yes,~~ Element 4 should be further ~~evaluated~~ No

See Chapter XI for an evaluation of the Fuel Oil Chemistry Program

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VII AUXILIARY SYSTEMS

H1. DIESEL FUEL OIL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H1.4.1	Tank	Internal Surfaces	Carbon Steel	Fuel Oil, Water	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	ASTM D 270. ASTM D 975. ASTM D 2276. Plant Technical Specifications.
H1.4.1	Tank	Internal Surfaces	Carbon Steel	Fuel Oil, Water	Buildup of Deposit	Biofouling	ASTM D 270. ASTM D 975. ASTM D 2276. Plant Technical Specifications.

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Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ water, biologics, and fungal has not occurred. Degradation of the protective coatings may expose tank internal surfaces to conditions that cause corrosion. The AMP should include inspection of tank internal surfaces to detect potential degradation of protective coating and measurement of tank bottom and sides near bottom for thickness using UT method. ***(5) Monitoring and Trending:*** Based on industry operating experience, quarterly sampling and analysis of fuel oil provide for timely detection of conditions directly related to corrosion of tank internal surfaces before the potential loss of the intended function of diesel fuel oil tank. ***(6) Acceptance Criteria:*** ASTM standard D 975 specifies acceptance criteria for the limits of water content, bacteria and fungal levels. Corrective actions are taken to prevent recurrence when the specified limits for fuel oil standards are exceeded or when excessive water is drained during periodic surveillance. ***(7) Corrective Actions:*** Specific corrective actions are implemented in accordance with the plant quality assurance (QA) program. For example, corrective actions are taken to prevent recurrence when the specified limits for fuel oil standards are exceeded or when excessive water is drained during periodic surveillance. Also, when the presence of biological activity is confirmed, a biocide is added to fuel oil. ***(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:*** Surveillance of diesel fuel oil tanks for ≈20 years of operation has shown no aging degradation. The results of quarterly sampling of a fuel oil tank for ≈15 years of operation indicate that the water content, biologics, and fungal levels were well below acceptance criteria.	
Same as for General and Microbiologically-Influenced Corrosion of Item H1.4.1 Tank internal surfaces.	*Same as for General and Microbiologically-Influenced Corrosion of Item H1.4.1 Tank internal surfaces.*	Yes, Element 4 should be further evaluated
Same as for General and Microbiologically-Influenced Corrosion of Item H1.4.1 Tank internal surfaces.	*Same as for General and Microbiologically-Influenced Corrosion of Item H1.4.1 Tank internal surfaces.*	Yes, Element 4 should be further evaluated

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VII/H1-8

VII AUXILIARY SYSTEMS
H1. DIESEL FUEL OIL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H1.4.1	Tank	Internal Surfaces	Carbon Steel	Fuel Oil, ~~Water~~	~~Corrosion Product Buildup~~ LOSS OF MATERIAL	Micro-biologically Influenced Corrosion	ASTM D 270. ASTM D 975. ASTM D 2276. Plant Technical Specifications.
H1.4.2	Tank	External Surfaces	Carbon Steel	Sun, Weather, Humidity and Moisture	Loss of Material	General Corrosion, Coating Degradation	*Operating Experience* GL 98-04
H1.4.2	Tank	External Surfaces	Carbon Steel	Sun, Weather, Humidity and Moisture	Local Loss of Material	Pitting Corrosion and Crevice Corrosion, Coating Degradation	*Operating Experience* GL 98-04
~~H1.4.3~~	~~Tank~~	~~Caulking and Sealant~~	~~Plastic Coal Tar~~	~~Sun, Weather, Humidity and Moisture~~	~~Increased Hardness and Shrinkage~~	~~Weather~~	~~-~~

Delete

VII/H1-9

VII H1-10

Existing Aging Management ~~Program (AMP)~~	Evaluation ~~and~~ Technical Basis	Further Evaluation
~~Same as for General and Microbiologically-Influenced Corrosion of Item H1.4.1 Tank internal surfaces.~~ Fuel Oil Chemistry	~~Same as for General and Microbiologically-Influenced Corrosion of Item H1.4.1 Tank internal surfaces.~~ See Chapter XI for an evaluation of the Fuel Oil Chemistry Program	~~Yes, Elements 4 should be further evaluated~~ No
Same as for General Corrosion of Item ~~H1.1.1 Aboveground piping and fittings.~~	Same as for General Corrosion of Item H1.1.1 ~~Aboveground piping and fittings.~~	Yes, ~~no generic~~ AMP
Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.	Same as for General Corrosion of Item H1.1.1 Aboveground piping and fittings.	Yes, no generic AMP
To prevent the tank bottom from corrosion, the joints between the ~~tank~~ bottom and the concrete support ring ~~are sealed with caulking and sealant.~~	Caulking and sealing help to protect tank bottom from ~~corrosion~~ by preventing water and moisture contacting with tank bottom. Caulking and sealant, however, may ~~degrade and corrosion may occur.~~ Thus, a new caulking/sealant inspection program should be implemented to ensure that caulking and sealant are intact and corrosion is adequately managed.	Yes, no generic AMP

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION VIIH.1

GALL SECTION	TITLE	ITEM NO.	PAGE	COMMENT
VII H1-1	Diesel Fuel Oil System	H1.1.1, H1.2.1, H1.2.2, H1.3.1, H1.3.2, & H.1.4.2	VII H1-4, 8, & 12.	Delete "coating degradation" from the Aging Mechanism column. BASIS: Failure of the coating does not result in a loss of the component function. The aging mechanism is corrosion that occurs as a result of the degradation of the coating that allows the environment to contact the metal surface.
VII H1-2	Diesel Fuel Oil System	H1.1.1, H1.2.1, H1.2.2, H1.3.1, H1.3.2, & H1.4.2	VII H1-5, 9, & 13. VII H1-4, 8, & 12.	The Existing Aging Management Program (AMP) and the Evaluation and Technical Basis columns should be reworded to say that the walkdowns inspect for signs of metal degradation instead of coating degradation. BASIS: The aging effect that this program should manage is loss of material of the underlying metal, which may not be occurring even though the coating is degraded. Also, walkdowns before, during, and after each refueling outage is excessive. Recommend that walkdowns need only be performed during each refueling outage.
VII H1-3	Diesel Fuel Oil System	H.1.1.2	VII H1-6	Delete Item H1.1.2 BASIS: Corrosion product buildup on the external surfaces of buried pipe will not result in a loss of the component function.
VII H1-5	Diesel Fuel Oil System	H1.1.2	VII H1-7	The wording in the Evaluation and Technical Basis column suggest periodic visual inspection of buried piping. Recommend deleting the wording and considering other alternatives. BASIS: Visual inspection of the buried piping requires digging around the pipe. This creates a potential risk to the coatings in that during the course of excavation and backfill the coatings could be damaged. Such damage could easily go undetected. This damage then would lead to corrosion of the underlying material that would not have occurred if it had been left alone.
VII H1-6	Diesel Fuel Oil System	H1.4.1	VII H1-12	Under the Environment column, delete the reference to water as part of the internal environment of the fuel oil tanks. BASIS: Water is a contaminant and should not be listed as an environment. Contaminants is treated water environments are not listed as the environment in other systems.
VII H1-7	Diesel Fuel Oil System	H.1.4.1	VII H1-9	Delete exiting text under the Existing Aging management program column and the Evaluation and Technical Basis column and replace with a reference to the Fuel Oil Chemistry Program. BASIS: The program described here is based on test methods described

GALL SECTION	TITLE	ITEM NO.	PAGE	COMMENT
				in the ASTM Standards. These are not plant programs. The plant program, typically the Chemistry Program, implements these standards for testing. Replace the program with the generic Chemistry Program (Fuel Oil) that has been provided.
VII H1-8	Diesel Fuel Oil System	H1.4.1	VII H1-12	Under the Aging Effect column, change "corrosion product buildup" to "local loss of material." BASIS: Corrosion product buildup on the external surfaces of the tank will not result in a loss of the component function.
VII H1-9	Diesel Fuel Oil System	H1.4.1	VII H1-12	Caulking and sealants perform no function in support of the component function of the tank or supports. Therefore, they are not within the scope of license renewal and should be deleted from this table.
VII H1-10	Diesel Fuel Oil System	H1.4.1	VII H1-13	In lieu of referencing back to a previous section here; insert the Fuel Oil Chemistry Program

H2. Emergency Diesel Generator System

H2.1 Diesel Engine Cooling Water Subsystem

H2.1.1 Pipe and Fittings

H2.2 Diesel Generator Air Starting Subsystem

H2.2.1 Pipe and Fittings

H2.2.2 Hand Valve

H2.2.3 Check Valve

H2.2.4 Drain Trap

H2.2.5 Air Accumulator Vessel

H2.3 Diesel Generator Combustion Air Intake Subsystem

H2.3.1 Piping and Fittings

H2.3.2 Filter

H2.3.3 Muffler

H2.4 Diesel Generator Combustion Exhaust Air Subsystem

H2.4.1 Piping and Fittings

H2.4.2 Muffler

H2.5 Diesel Generator Fuel Oil Subsystem

H2.5.1 Day Tank

H2.5.2 Dip Tank

H2.5.3 Strainer

H2. Emergency Diesel Generator System

System, Structures, and Components

The system, structures, and components included in this table comprise the emergency diesel generator system and contain piping, valves, filter, muffler, strainer, day tank, and dip tank for cooling water, starting air, combustion air intake, combustion exhaust air, and diesel fuel oil subsystems. 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 diesel generator system are classified as Group C Quality Standards.

System Interfaces

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

VII AUXILIARY SYSTEMS

H2. EMERGENCY DIESEL GENERATOR SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
H2.1.1	Diesel Engine Cooling Water Subsystem	Piping and Fittings	Carbon Steel	Chemically Treated Demineralized Water	Loss of Material	Pitting and ~~Crevice~~ Corrosion, General Corrosion VII H2-1	ASME Section XI (edition specified in 10 CFR 50.55a). Plant Technical Specifications.

VII
H2-2

See Chapter XI for an evaluation of the Closed Cooling Water Chemistry Program

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~The AMP relies on minimizing impurities by monitoring and maintaining the chemistry of system water (i.e. chemically treated de-mineralized water) implemented through plant technical specifications and inservice inspection (ISI) in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Table IWD 2500-1, test and examination category D-B for Class 3 pressure retaining components.~~ Closed Cooling Water Chemistry	~~***(1) Scope of Program:*** The program relies on monitoring and maintaining the chemistry conditions of the process fluid (i.e. the demineralized water) and ASME Section XI inservice inspection (ISI) to manage the effects of pitting corrosion and crevice corrosion on the intended function of the components. ***(2) Preventive Actions:*** The AMP consists of monitoring and controlling the system water chemistry (i.e. the Chemically Treated Demineralized Water) to mitigate the corrosion effects and to ensure that no adverse chemistry conditions are present. Monitoring and maintaining the chemistry conditions of the demineralized water will help to mitigate the effects of component degradation by controlling the impurities in the system fluid. ***(3) Parameters Monitored/Inspected:*** The program generally contains chemical parameter specifications, sampling frequency, analysis and corrective actions. The parameters monitored generally include dissolved iron, dissolved copper, chlorides, dissolved oxygen, suspended solids, pH, and hydrazine. They are directly related to potential of corrosion. Examination category D-B of ASME Section XI Table IWD 2500-1 requires visual VT-2 examination during system leakage test and system hydrostatic test to detect the leakage. ***(4) Detection of Aging Effects:*** Within the emergency diesel generator cooling water system, there are regions of low or stagnant flow conditions that may cause crevice corrosion and pitting at the crevices where impurities and/or corrosive chemicals may concentrate. Therefore, an one time inspection of representative components and susceptible locations should be undertaken to ensure that significant corrosion is not occurring. Based on piping/component geometry and fluid flow conditions, susceptible locations can be identified. Follow up actions are based on the inspection results and plant technical specification. ***(5) Monitoring and Trending:*** The frequency of water chemistry monitoring ranges from several times per week to once a month. The results should provide data for trending. The result of one time inspection should be used to dictate the future inspection. ***(6) Acceptance Criteria:*** The chemistry monitoring program provides chemical parameter specification and acceptable levels. Any relevant conditions that may be detected during the leakage and hydrostatic tests are evaluated in accordance with ASME Section XI IWD-3000. ***(7) Corrective Actions:*** Plant chemistry control program specifies the target values for each chemistry parameter in the treated water. If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. Corrective actions of the above one time inspection are based on the results of the inspection. Furthermore, IWA-5250 requires that the source of leakage detected during the pressure test should be located and evaluated for corrective measures. Repair and replacement are in accordance with~~	~~Yes. Element 4 should be further evaluated~~ No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H2.1.1	Diesel Engine Cooling Water Subsystem	Piping and Fittings	Carbon Steel	Chemically Treated Demineralized Water	Wall Thinning	Erosion/ Corrosion	NRC IEB 87-01. NRC GL 89-08. NRC IN 86-106 and S 1, 2, and 3. NRC IN 87-36. NRC IN 88-17.

Delete

VII H2-3

VII AUXILIARY SYSTEMS
H2. EMERGENCY DIESEL GENERATOR SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~(continued from previous page)~~ IWA-4000 and IWA-7000. ***(8 & 9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** Within the closed cycle cooling water system, there are regions of low or stagnant flow conditions that may cause crevice corrosion and pitting at the crevices where impurities and/or ~~corrosive chemicals may concentrate.~~	
~~Due to the low flow velocity and low~~ operating temperature of the EDG cooling water system, the effects of erosion/corrosion are generally not monitored/inspected. However, the system is chemically treated with hydrazine to lower the dissolved oxygen level in order to minimize the corrosion effects. Lowering the oxygen content increases the susceptibility of the carbon steel piping to erosion/ corrosion. Therefore, an inspection program should be implemented to ensure that erosion/corrosion has not occurred at susceptible locations of the EDG cooling water components. Corrective actions should be initiated if the wall thickness is insufficient for the component to perform its intended function during the period of extended ~~operation.~~ All H2-3	~~(1) Scope of Program: No AMP exists because the low fluid~~ flow conditions and low operating temperature are outside the maximum erosion/corrosion conditions. ***(2) Preventive Actions:*** Inspection program should be implemented for the EDG cooling water system to ensure that erosion/corrosion has not occurred at susceptible component locations. ***(3) Parameters Monitored/Inspected:*** Inspection such as ultrasonic examination should be conducted periodically at the susceptible locations such as elbows and tees where fluid flows are much higher. The parameter inspected is the wall thickness. ***(4) Detection of Aging Effects:*** Any evidence of wall thinning due to erosion/corrosion should be detected by ultrasonic testing. ***(5) Monitoring and Trending:*** Effects of erosion/corrosion are detectable by ultrasonic examination and inspection is periodic should assure timely detection of aging effects before there is a loss of the component intended function. ***(6) Acceptance Criteria:*** The inspection program should include acceptance criteria against the need for corrective action. ***(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:*** Wall thinning due to erosion/corrosion is a significant problem in high-energy carbon steel piping systems, such as feedwater line. Numerous cases of wall thinning in feedwater line due to erosion/corrosion have been reported in NRC IE Bulletin 87-01, Generic Letter (GL) 89-08, Information Notice (IN) 86-106 and Supplements 1, 2, and 3, IN 87-36, and IN 88-17. Although, no major problem of wall thinning has occurred in the DFG cooling water system components. Applicants should review this information for applicability to their facilities and consider actions as appropriate.	Yes, no generic AMP

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H2.2.1 thru H2.2.5	Diesel Engine Starting Air Subsystem	Piping and Fittings, Hand Valve, Check Valve, Drain Trap, Air Accumulator Vessel	Carbon Steel	Moist Air	Loss of Material	General, Pitting, and Crevice Corrosion	-
H2.3.1 H2.3.2 H2.3.3	Diesel Engine Combustion Air Intake Subsystem	Piping and Fittings, Filter, Muffler	Carbon Steel	Moist Air	Loss of Material	General, Pitting, and Crevice Corrosion	-

VII H2-4

Plant Specific Aging Management Activity/Program required

VII AUXILIARY SYSTEMS
H2. EMERGENCY DIESEL GENERATOR SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Moisture in the EDG starting air~~ subsystem may result in corrosion of the starting air components. The AMP should rely on regular maintenance, overhaul, and periodic inspection of the EDG air starting components such as starting air distributor and filters, hand valves, and check valves for inspection specifically for the presence of corrosion debris that could indicate the starting air subsystem is undergoing corrosion. Correction actions should be ~~initiated as necessary.~~ Plant Specific Aging Management Activity/Program	*(1)* ~~*Scope of Program:*~~ The program should focus on managing the effects of corrosion on the intended function of the EDG starting air components. ***(2) Preventive Actions:*** Periodic visual inspection, periodic overhaul, and regular maintenance of the EDG starting air components should be conducted to mitigate the aging effects due to corrosion. ***(3) Parameters Monitored/Inspected:*** The EDG starting air components should be periodically inspected for the presence of corrosion debris that indicates the starting air subsystem is undergoing corrosion. ***(4) Detection of Aging Effects:*** The debris due to general corrosion such as superficial rust speckles and a slight dusting of loose passive surface rust should be observed by visual inspection. Periodic inspection should be conducted to provide timely detection of the aging effects before there is a loss of the component intended function. ***(5) Monitoring and Trending:*** Periodic inspection and overhaul should provide data for trending. ***(6) Acceptance Criteria:*** Any significant degradation should reported and evaluated. ***(8-9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls should be implemented in accordance with Appendix B to 10 CFR Part 50 requirements and should continue to be adequate for license renewal. ***(10) Operating Experience:*** No significant aging problem is reported of the EDG starting ~~air components.~~	Yes, no generic AMP.
~~Moisture in the EDG combustion air~~ intake system may result in corrosion in the EDG air intake components. The AMP should rely on regular maintenance, overhaul, and periodic inspection of the EDG air intake components such as air intake filters, intake mufflers, and check valves for inspection for the presence of corrosion debris that could indicate ~~the EDG~~ air intake ~~system is undergoing~~ corrosion. Correction actions should be initiated as necessary.	~~*(1) Scope of Program:* The program should focus on~~ managing the effects of corrosion on the intended function of the EDG air intake components. ***(2) Preventive Actions:*** Periodic visual inspection, periodic overhaul, and regular maintenance of the EDG air intake components should be conducted to mitigate the aging effects due to corrosion. ***(3) Parameters Monitored/ Inspected:*** The air intake components should be periodically inspected for the presence of corrosion debris that indicates the air intake system is undergoing corrosion. ***(4) Detection of Aging Effects:*** The debris due to general corrosion such as superficial rust speckles and a slight dusting of loose passive surface rust should be observed by visual inspection. Periodic inspection should be conducted to provide timely detection of the aging effects before there is a loss of the component intended function. ***(5) Monitoring and Trending:*** Periodic inspection and overhaul should provide data for trending. ***(6) Acceptance Criteria:*** Any significant degradation should reported and evaluated. ***(8-9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls should be implemented in accordance with Appendix B to 10 CFR Part 50 requirements and should continue to be adequate for license renewal. ***(10) Operating Experience:*** No ~~significant aging problem~~ is reported of the EDG air intake components	Yes, no generic AMP.

VII AUXILIARY SYSTEMS
H2. EMERGENCY DIESEL GENERATOR SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
H2.4.1 H2.4.2	Diesel Engine Combustion Air Exhaust Subsystem	Piping and Fittings, Muffler	Carbon Steel	Hot Diesel Engine Exhaust Gases containing Moisture and Particulate	Loss of Material	General, Pitting, and Crevice Corrosion	Plant Technical Specifications.
H2.4.2	Diesel Engine Combustion Air Exhaust Subsystem Delete VII H2-5	Muffler	Carbon Steel	Hot Diesel Engine Exhaust Gases	Wall Thinning	Particulate Wear Erosion	-

VII H2-4

Plant specific Aging Management Activity / Program required

Existing Aging Management Program (AMP)	Evaluation ~~and Technical Basis~~	Further Evaluation
~~Moisture in the EDG combustion air~~ exhaust system may result in corrosion of the EDG exhaust air piping and mufflers. The AMP should rely on regular maintenance, overhaul, and periodic inspection of the EDG exhaust piping and muffler for inspection specifically for the presence of corrosion debris that could indicate the EDG ~~exhaust air subsystem is~~ undergoing corrosion. Correction ~~actions should be initiated as necessary~~. Plant Specific Aging Management/Activity	~~*(1) Scope of Program:* The program should focus on~~ managing the effects of corrosion on the intended function of the EDG exhaust air components. ***(2) Preventive Actions:*** Periodic visual inspection, periodic overhaul, and regular maintenance of the EDG exhaust air components should be conducted to mitigate the aging effects due to corrosion. ***(3) Parameters Monitored/ Inspected:*** The EDG exhaust air components should be periodically inspected for the presence of corrosion debris that indicates the EDG exhaust air system is undergoing corrosion. ***(4) Detection of Aging Effects:*** The debris due to general corrosion such as superficial rust speckles and a slight dusting of loose passive surface rust should be observed by visual inspection. Periodic inspection should be conducted to provide timely detection of the aging effects before there is a loss of the component intended function. ***(5) Monitoring and Trending:*** Periodic inspection and overhaul should provide data for trending. ***(6) Acceptance Criteria:*** Any significant degradation should be reported and evaluated.. ***(8-9) Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls should be implemented in accordance with Appendix B to 10 CFR Part 50 requirements and should continue to be adequate for license renewal. ***(10) Operating ~~Experience:~~*** ~~No~~ significant aging problem is reported of the EDG exhaust ~~air components~~.	Yes, Element 6 should be further evaluated.
~~Hot exhaust gases with particulate and~~ moisture may erode internal surfaces of the EDG exhaust air muffler. No AMP exists for maintaining the intended function of the muffler during the period of extended operation. Therefore, an inspection program should be implemented to ensure that particulate wear erosion of the muffler has not occurred and the intended function of muffler is maintained. Corrective actions should be initiated as ~~necessary~~. Delete Per H2-5	~~*(1) Scope of Program:* An inspection program should be~~ implemented for managing the aging effects of particulate wear erosion on the intended function of the EDG exhaust air muffler. ***(2) Preventive Actions:*** Periodic visual inspections of the internal surfaces on representative samples should be conducted to manage the aging effects due to particulate wear erosion. ***(3) Parameters Monitored/Inspected:*** The muffler should be disassembled and inspected for signs of particulate wear erosion. ***(4) Detection of Aging Effects:*** The inspection program should include inspection representative size, inspection requirements, inspection frequency, acceptance criteria, and corrective actions. Visual inspection is an effective method for detecting wear erosion in a disassembled EDG exhaust air muffler. ***(5) Monitoring and Trending:*** Periodic inspection provides data for trending and timely detection of the aging effect. ***(6) Acceptance Criteria:*** The inspection program should include acceptance criteria. ***(7-9) Corrective Actions, Confirmation Process, and Administrative Controls:*** Site corrective actions program, QA procedures, site review and approval process, and administrative controls are implemented in accordance with Appendix B to 10 CFR Part 50 requirements and will continue to be adequate for license renewal. ***(10) Operating Experience:*** No significant aging problem is reported of the ~~DEG exhaust air muffler~~ due to particulate wear erosion.	Yes, no generic AMP

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H2.5.1 H2.5.2	Diesel Engine Fuel Oil Subsystem	Day Tank, Dip Tank	Carbon Steel	Diesel Fuel Oil	Loss of Material	General, Micro-biologically-Influenced, Pitting, and Crevice Corrosion	ASTM D 270. ASTM D 975. ASTM D 2276.

VII H2-7

See Chapter XI for an evaluation of the fuel oil chemistry program

Existing Aging Management Program (AMP)	~~Evaluation and Technical Basis~~	Further Evaluation
~~General corrosion~~ and biologically influenced corrosion may occur in the EDG tanks due to presence of condensed water and biological contaminants in the fuel oil. The AMP is similar to that for managing the effects of corrosion of the Diesel Fuel Oil Storage Tank of the Diesel Fuel Oil System (Item H1.4.1 of Table VII.H1). The AMP consists of a combination of surveillance and maintenance procedures. The AMP includes, (1) Periodic draining of water collected at bottom of the tank. If excessive water is found, corrective actions are taken to prevent recurrence. (2) Sampling, monitoring, and maintaining the fuel oil chemistry within specifications established in the industry codes, such as ASTM specifications D 270, "Standard Method of Sampling Petroleum and Petroleum Products," D 975, "Standard Specification for Diesel Fuel Oils," and D 2276, "Standard Test Method for Particular Contamination in Aviation Fuel." (3) New fuel oil deliveries are treated with corrosion inhibitors and a biocide and sampled and analyzed for ~~water content.~~ Fuel Oil Chemistry Program	~~*(1) Scope of Program:* The program is focused on managing~~ the effects of general corrosion and microbiologically-induced corrosion of the EDG tanks due to exposure to fuel oil contaminated with water, biologics and fungal. ***(2) Preventive Actions:*** Periodic draining of water collected at bottom of the tank minimizes the amount of water and the length of contact time. Compliance with ASTM standards D 270 and D 975 and addition of corrosion inhibitors and biocides to new fuel oil, provide adequate measures to control and maintain the standards for diesel fuel oils. ***(3) Parameters Monitored/ Inspected:*** The AMP monitors water, biological, and fungal levels in the fuel oil, which cause loss of material of the tank internal surfaces. ASTM standard D 270 defines fuel oil specifications for viscosity, percent water and sediment, particulate contamination, and biologics, and requires multilevel sampling and analysis of fuel oil to detect the presence of water, biologic and fungal, which cause ~~corrosion of tank~~ internal surfaces. ASTM standard D 2276 provides guidance to quantify insoluble particulate contamination in diesel fuel. ***(4) Detection of Aging Effects:*** Although compliance with diesel fuel oil standards and periodic multilevel sampling provide assurance that fuel oil contaminants are below acceptable levels, the AMP does not ensure that degradation of tank internal surfaces has not occurred due to exposure to water, biologics, and fungal. The AMP should include inspection of tank internal surfaces to ensure no degradation of tank internal surfaces and measurement of tank bottom and sides near bottom for thickness using UT method. ***(5) Monitoring and Trending:*** Based on industry operating experience, quarterly sampling and analysis of fuel oil provide for timely detection of conditions directly related to corrosion of tank internal surfaces before the potential loss of the intended function of the EDG fuel oil tanks. ***(6) Acceptance Criteria:*** ASTM standard D 975 specifies acceptance criteria for the limits of water content, bacteria and fungal levels. Corrective actions are ~~taken to prevent recurrence when the specified limits for~~ fuel oil standards are exceeded or when excessive water is drained during periodic surveillance. ***(7) Corrective Actions:*** Specific corrective actions are implemented in accordance with the plant quality assurance (QA) program. For example, corrective actions are taken to prevent recurrence when the specified limits for fuel oil standards are exceeded or when excessive water is drained during periodic surveillance. Also, when the presence of biological activity is confirmed, a biocide is added to fuel oil. ***(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.	~~Yes,~~ Element 4 should be further ~~evaluated~~ No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
H2.5.3	Diesel Engine Fuel Oil Subsystem	Strainer	Cast iron	Diesel Fuel Oil	Loss of Material	General, Micro-biologically -Influenced, Pitting, and Crevice Corrosion	ASTM D 270. ASTM D 975. ASTM D 2276.

VII H2-7

VII AUXILIARY SYSTEMS

H2. EMERGENCY DIESEL GENERATOR SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	~~*(continued from previous page)*~~ ***(10) Operating Experience:*** Surveillance of diesel fuel oil tanks for a 20 years of operation has shown no aging degradation. The results of quarterly sampling of a fuel oil tank for a 15 years of operation indicate that the water content, biologics, and fungal levels were well below acceptance criteria.	
Same as the effects of General Corrosion on Items H2.5.1 day tank and H2.5.2 dip tank.	*Same as the effects of General Corrosion on Items H2.5.1 day tank and H2.5.2 dip tank.*	Yes, Element 4 should be further evaluated

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION VIIH.2

GALL SECTION	TITLE	ITEM NO.	PAGE	COMMENT
VII H2-1	Emergency Diesel Generator System	H.2.1.1	VII H2-4	Add general corrosion to the Aging Mechanism column.
VII H2-2	Emergency Diesel Generator System	H.2.1.1	VII H2-4	The program described in the Existing Aging Management Program (AMP) and the Evaluation and Technical Basis columns should be replaced with the Chemistry Program (Closed Cooling) provided. BASIS: The Chemistry Program (Closed Cooling) will manage loss of material due to general, crevice, and pitting corrosion. See write-up in Chapter XI.
VII H2-3	Emergency Diesel Generator System	H2.1.1	VII H2-6	Delete Item H.2.1 BASIS: Erosion-corrosion is not an aging mechanism applicable to this system. This system does not meet any of the criteria for erosion-corrosion to be a concern. As a result this system is not within the scope of the plant Flow Accelerated Corrosion Program. In addition, there is not operating experience showing that this is a concern.
VII H2-4	Emergency Diesel Generator System	H2.2.1 –5, & H2.3.1 –3	VII H2-9	The aging management programs described here are site specific maintenance activities instead of generic plant programs. We recommend revising the Existing Aging Management Program (AMP) and Evaluation and Technical Basis columns to reflect that these aging effects are managed by site specific activities.
VII H2-5	Emergency Diesel Generator System	H2.4.2	VII H2-10	Delete Item H2.4.2 BAIS: In exhaust gases, particulates in the gas are not traveling at the speed to erode the muffler surface. The exhaust gases are corrosive, but not erosive, therefore, the aging mechanism “Particulate Wear Erosion” is not applicable. In addition, the diesels are normally in standby and operated only for periodic testing which would make erosion insignificant if the gases were erosive.
VII H2-7	Emergency Diesel Generator System	H2.5.1, H2.5.2, & H2.5.2	VII H2-13	Replace the program described with the Fuel Oil Chemistry Program. BASIS: The program described is based on test methods delineated in the ASTM Standards. These are not plant programs. The plant program, typically the Chemistry Program, implements these standards for testing.

I Liquid Waste Disposal System

I.1 Piping

I.2 Pumps

I.3 Valves

I.4 Tanks

I.5 Evaporators

I.6 Demineralizers

I.7 Gas Strippers

I. Liquid Waste Disposal System

System, Structures, and Components

The system, structures, and components included in this table comprise the liquid waste disposal system, which collects, monitors, and recycles or releases all potentially radioactive liquid wastes produced by boiling or pressurized water reactors in the U.S. The major components of this system are the piping, pumps, valves, tanks, evaporators, demineralizers, and gas strippers. All of these components are fabricated of austenitic stainless steel except for the piping, which may be carbon, low-alloy, or austenitic stainless steel. Based on U.S. 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 liquid waste disposal system are classified as Quality Standards Group D with the exception of the containment penetration piping out to the second isolation valve from the containment sump pump discharge, which is Quality Standards Group B.

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

System Interfaces

The systems that interfaces with the liquid waste disposal system include the recirculating water cooling system (BWRs) or the steam generator blowdown subsystem (PWRs), as well as with other potential sources of liquid radioactive waste, including the auxiliary building equipment and floor drains, chemical and regeneration waste drains, turbine building equipment and floor drains, and the condensate polisher sump.

VII AUXILIARY SYSTEMS

I. LIQUID WASTE DISPOSAL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
I.1	Carbon and Low Alloy Steel Piping	OD surfaces	Carbon and Low-Alloy Steel	Air and (for some plants) borated water leakage at OD External wetting from treated and raw water systems VII I-1	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	NRC IN 79-19.

Plant specific aging management program/activity required.

VII AUXILIARY SYSTEMS
I. LIQUID WASTE DISPOSAL SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Pitting corrosion and crevice corrosion~~ may occur in portions of the system in contact with borated water, such as external surfaces that experience intermittent wetting and evaporation. The AMPs to deal with this potential problem are detailed in the Plant Technical Specifications and rely on minimizing impurities by monitoring and maintaining the borated water chemistry conditions. The program contains chemical parameter specifications, sampling frequency, analysis, and corrective actions. Chemical parameters and impurities are sampled and monitored periodically. Based on operating conditions, the sampling frequency ranges from daily, weekly, monthly, to quarterly. If the specified values are exceeded, corrective actions are initiated to bring the chemistry parameters back to normal levels. Plant specific aging management program/ activity	~~*(1) Scope of Program:*~~ The program relies on monitoring and maintaining the chemistry conditions of the borated water for managing the effects of pitting corrosion and crevice corrosion on the intended function of the components. ***(2) Preventive Actions:*** Monitoring and maintaining the system chemistry conditions will help minimize the rate and effects of component degradation by minimizing the impurities in the system fluid. The AMP, however, is inadequate to manage the effects of pitting corrosion and crevice corrosion that may occur at external surfaces that may experience intermittent wetting and evaporation, where impurities in borated water may concentrate over the years. Therefore, an inspection program should be implemented to ensure that pitting corrosion and crevice corrosion have not occurred. ***(3) Parameters Monitored/ Inspected:*** The chemistry of the borated water is monitored and controlled to mitigate the effects of pitting corrosion and crevice corrosion on the intended function of the component. However, high concentrations of impurities at external surfaces that may experience intermittent wetting and evaporation could cause pitting and crevice corrosion under crevice conditions. Therefore, the AMP should include an inspection of aging effects at susceptible locations of the component to ensure pitting corrosion and crevice corrosion are adequately managed. ***(4) Detection of Aging Effects:*** The existing AMP should include inspection and/or testing samples of the component for timely detection of aging effects due to pitting corrosion and crevice corrosion. Programs such as visual inspection and ultrasonic thickness measurement are effective methods to ensure that the effects of pitting corrosion and crevice corrosion have not occurred and the intended functions are maintained. ***(5) Monitoring and Trending:*** The results of the inspection should be used to dictate the frequency of future inspections. **(6) Acceptance Criteria:** Any degradation is evaluated in accordance with IWE-3100 or IWB-3100 by comparing ISI results with the acceptance standards of IWE-3400 or IWB-3400. ***(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:*** Boric acid corrosion has not been reported in liquid waste disposal system components, but several through-wall cracks at piping welds have been found in spent fuel cooling systems ~~(IN 79-19)~~.	Yes. ~~Elements 3 through 6 should be further evaluated~~

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VII AUXILIARY SYSTEMS

I. LIQUID WASTE DISPOSAL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
I.1	Carbon and Low Alloy Steel Piping	OD surfaces	Carbon and Low-Alloy Steel	Air and (for some plants) borated water leakage at OD	Loss of Material	~~Corrosion/~~ Boric Acid Wastage at External Surfaces	NRC GL 88-05. ASME Section XI, 1989 Edition. NRC IN 86-108 S3.
I.1	SAME	SAME	SAME	SAME	SAME	Corrosion	

See Chapter XI for an evaluation of the Boric Acid Corrosion Program

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~Implementation of NRC Generic Letter 88-05, and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Subsection IWE, Table IWE 2500-1 (or Subsection IWC, Table IWC 2500-1 for Quality Group B piping).~~ Boric Acid Corrosion Program VII I-	~~**(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 components 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). **(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 hydrostatic test is conducted 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 ASME Section XI requirements. **(7) Corrective Actions:** Repair and replacement is in conformance with ASME Section XI requirements. **(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.~~	No
Plant Specific Aging Management Program/Activities	Plant specific aging management program/activity required	

VII AUXILIARY SYSTEMS

I. LIQUID WASTE DISPOSAL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
I.1	Carbon and Low Alloy Steel Piping	ID surfaces	Carbon and Low-Alloy Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Local Loss of Material	Pitting Corrosion and Crevice Corrosion	
I.1	Carbon and Low Alloy Steel Piping	ID surfaces	Carbon and Low-Alloy Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Loss of Material	Corrosion/ Boric Acid Wastage at Internal Surfaces	
I.1 Delete Item VII I-4	Stainless Steel Piping	OD surfaces	Stainless Steel	Air and (for some plants) borated water leakage at OD	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44.

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 generic AMP
Plant-specific aging management program.	Plant-specific aging management program will be evaluated.	Yes. No generic AMP
~~Guidelines of Regulatory Guide (RG) 1.44 to avoid sensitization of stainless steels (SSs) and control water chemistry and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a), Subsection IWE, Table IWE 2500-1, (or Subsection IWC, Table IWC 2500-1 for Quality Group B piping) for pressure retaining welds in austenitic stainless steel and high alloy piping.~~ VII I-4	~~***(1) Scope of Program:*** The program includes preventive 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 requirements of Regulatory Guide (RG) 1.44 prevent or mitigate SCC. Also, control of halogens and oxygen in the water during operation mitigate the potential for SCC, though introduction and concentration of impurities at external surfaces, particularly in crevices, is still possible. ***(3) Parameters Monitored/Inspected:*** The parameters monitored are concentrations of impurities in the containment spray system to reduce the potential for stress corrosion cracking at the weld heat-affected zones. Periodic surface and volumetric inspections are required for Class 2 piping welds. 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 the piping due to SCC can not occur without crack initiation and growth. ASME Section XI inspection requires examination of only the welds and weld regions, but SCC is not expected to propagate into the base metal beyond the HAZ.~~	No

VII AUXILIARY SYSTEMS

I. LIQUID WASTE DISPOSAL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
I.1	Stainless Steel Piping	ID surfaces	Stainless Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition. Regulatory Guide 1.44.

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
VII I-4	(continued from previous page) **(5) *Monitoring and Trending:*** Inspection schedule in accordance with IWE-2400 should provides timely detection of cracks. ***(6) Acceptance Criteria:*** Any IGSCC degradation is evaluated in accordance with IWE-3100 by comparing ISI results with the acceptance standards of IWE-3400. ***(7) Corrective Actions:*** Repair and replacement are in conformance with IWA-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 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Piping in the containment spray system of PWRs has generally not been found to be affected by SCC because of control of water chemistry, significant potential of SCC exists from inadvertent introduction of impurities resulting from contact with the piping external surfaces.	
~~Guidelines of Regulatory Guide (RG) 1.44~~ to avoid sensitization of stainless steels (SSs) and control water chemistry and inservice inspection in conformance with ASME Section XI (edition specified in 10 CFR 50.55a) Subsection IWE, Table IWE 2500-1, (or Subsection IWC, Table IWC 2500-1 for Quality Group B piping) for pressure retaining welds in austenitic stainless steel and high alloy piping. Primary Water Chemistry	~~***(1) Scope of Program:*** The program includes preventive~~ 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 requirements of Regulatory Guide (RG) 1.44 prevent or mitigate SCC. Also, control of halogens and oxygen in the water during operation mitigate the potential for SCC, though introduction and concentration of impurities in the waste streams is still possible. ***(3) Parameters Monitored/Inspected:*** The parameters monitored are concentrations of impurities in the containment spray system to reduce the potential for stress corrosion cracking at the weld heat-affected zones. Periodic surface and volumetric inspections are required for Class 2 piping welds. 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 the piping due to SCC can not occur without crack initiation and growth. ASME Section XI inspection requires examination of only the welds and weld regions, but SCC is not expected to propagate into the base metal beyond the HAZ. ***(5) Monitoring and Trending:*** Inspection schedule in accordance with IWE-2400 or IWB-2400 should provides timely detection of cracks. ***(6) Acceptance Criteria:*** Any IGSCC degradation is evaluated in accordance with IWE-3100 or IWB-3100 by comparing ISI results with the acceptance standards of IWE-3400 or IWB-3400. ***(7) Corrective Actions:*** Repair and replacement are in ~~conformance with IWA-~~	

VII I-5

See Chapter XI for an evaluation of the Primary Water Chemistry program

VII AUXILIARY SYSTEMS

I. LIQUID WASTE DISPOSAL SYSTEM

Item	Structure and Component	Region of Interest	Material	Environment	Aging Effect	Aging Mechanism	References
I.2	Pumps Delete VII I-4	~~OD surfaces~~	~~Stainless Steel~~	~~Air and (for some plants) borated water leakage at OD~~	~~Crack Initiation and Growth~~	~~Stress Corrosion Cracking (SCC)~~	~~ASME Section XI, 1989 Edition, Regulatory Guide 1.44.~~
I.2	Pumps	ID surfaces	Stainless Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition, Regulatory Guide 1.44.
I.3	Valves Delete	~~OD surfaces~~	~~Stainless Steel~~	~~Air and (for some plants) borated water leakage at OD~~	~~Crack Initiation and Growth~~	~~Stress Corrosion Cracking (SCC)~~	~~ASME Section XI, 1989 Edition, Regulatory Guide 1.44.~~
I.3	Valves VII I-4	ID surfaces	Stainless Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides in plants located near the ocean	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition, Regulatory Guide 1.44.
I.4	Tanks Delete	~~OD surfaces~~	~~Stainless Steel~~	~~Air and (for some plants) borated water leakage at OD~~	~~Crack Initiation and Growth~~	~~Stress Corrosion Cracking (SCC)~~	~~ASME Section XI, 1989 Edition, Regulatory Guide 1.44.~~

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(continued from previous page) 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 10 CFR Part 50 and will continue to be adequate for the period of license renewal. ***(10) Operating Experience:*** Piping in the containment spray system of PWRs has generally not been found to be affected by SCC because of control of water chemistry.	No
~~*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (OD).*~~	~~*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (OD).*~~	~~No~~
Same as effects of Stress Corrosion Cracking on Item I.1: Piping (ID).	*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (ID).*	No
~~*Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (OD).*~~	~~*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (OD).*~~	~~No~~
Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (ID).	*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (ID).*	No
~~*Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (OD).*~~	~~*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (OD).*~~	~~No~~

VII I-4

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
I.4	Tanks	ID surfaces	Stainless Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition, Regulatory Guide 1.44.
~~I.5~~	~~Evaporators~~	~~OD surfaces~~	~~Stainless Steel~~	~~Air and (for some plants) borated water leakage at OD~~	~~Crack Initiation and Growth~~	~~Stress Corrosion Cracking (SCC)~~	~~ASME Section XI, 1989 Edition, Regulatory Guide 1.44.~~
I.5	Evaporators Delete VII I-4	ID surfaces	Stainless Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition, Regulatory Guide 1.44.
~~I.6~~	~~Demineralizers~~	~~OD surfaces~~	~~Stainless Steel~~	~~Air and (for some plants) borated water leakage at OD~~	~~Crack Initiation and Growth~~	~~Stress Corrosion Cracking (SCC)~~	~~ASME Section XI, 1989 Edition, Regulatory Guide 1.44.~~
I.6	Demineralizers	ID surfaces	Stainless Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition, Regulatory Guide 1.44.

VII AUXILIARY SYSTEMS
I. LIQUID WASTE DISPOSAL SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (ID).	*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (ID).* VII I-4	No
~~*Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (OD).*~~	~~*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (OD).*~~	~~No~~
Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (ID).	*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (ID).* VII I-4	No
~~*Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (OD).*~~	~~*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (OD).*~~	~~No~~
Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (ID).	*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (ID).*	No

Item	Structure and Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
~~I.7~~ Delete	~~Gas Strippers~~	~~OD surfaces~~ VII I-4	~~Stainless Steel~~	~~Air and (for some plants) borated water leakage at OD~~	~~Crack Initiation and Growth~~	~~Stress Corrosion Cracking (SCC)~~	~~ASME Section XI, 1989 Edition, Regulatory Guide 1.44.~~
I.7	Gas Strippers	ID surfaces	Stainless Steel	Borated waste water (for some plants) with various impurities at ID, including possible chlorides particularly in plants located near the ocean	Crack Initiation and Growth	Stress Corrosion Cracking (SCC)	ASME Section XI, 1989 Edition, Regulatory Guide 1.44.

VII I-4

VII AUXILIARY SYSTEMS

I. LIQUID WASTE DISPOSAL SYSTEM

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
~~*Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (OD).*~~	~~*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (OD).*~~	~~No~~
Same as effects of Stress Corrosion Cracking on Item I.1: Stainless Steel Piping (ID).	*Same as effects of Stress Corrosion Cracking on Item I.1: Piping (ID).*	No

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.

10 CFR 50, Appendix R, *Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979*, Office of the Federal Register, National Archives and Records Administration, January 1997.

ACI Standard 318-63, *Building Code Requirements for Reinforced Concrete*, American Concrete Institute.

ACI Standard 349-85, *Code Requirements for Nuclear Safety Related Structures*, American Concrete Institute.

ACI Standard 201.2R-67, *Guide to Durable Concrete*, American Concrete Institute.

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

ANSI N14.6, *Radioactive Materials - Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More*, American National Standards Institute, 1993.

ASME B30.2, *Below-the-hooks Lifting Devices*, The American Society of Mechanical Engineers, New York, NY, 1993.

ASME NOG-1-1998, *Rules for Construction of Overhead and Gantry Cranes Running Bridge - Multiple Girder*, The American Society of Mechanical Engineers, New York, NY, 1998.

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.

ASTM D 270, *Standard Method of Sampling Petroleum and Petroleum Products*, The American Society of Testing Material.

ASTM D 975, *Standard Specification for Diesel Fuel Oils*, The American Society of Testing Material.

ASTM D 2276, *Standard Test Method for Particular Contamination in Aviation Fuel*, The American Society of Testing Material.

BWRVIP-29, *BWR Water Chemistry Guidelines, 1996 Revision*, or *BWRVIP-29, EPRI Report TR-103515-R1*, December 1996.

CMAA Specification #70, *Specifications for Top Running & Gantry Type Multiple Girder Electric Overhead Traveling Cranes*, The Crane Manufacture Association of America, 1994.

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.

INPO SOER 88-01, *Instrument Air System Failures*, May 18, 1988.

NRC Bulletin No. 87-01, *Thinning of Pipe Walls in Nuclear Power Plants*, July 9, 1987.

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, *NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping*, January 25, 1988.

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 88-14, *Instrument Air Supply System Problems Affecting Safety-Related Equipment*, August 8, 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 89-13, *Service Water System problems Affecting Safety-Related Equipment*, July 18, 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 96-04, *Boraflex Degradation in Spent Fuel Pool Storage Racks*, June 26, 1996.

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

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

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

NRC IN 79-07, *Rupture of Radwaste Tanks*, March 23, 1979.

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

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

NRC Information Notice 81-38, *Potentially Significant Equipment Failures Resulting from Contamination of Air-Operated Systems*, November 16, 1882.

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

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

NRC Information Notice 85-34, Heat *Tracing Contributes to Corrosion Failure of Stainless Steel Piping*, April 30, 1985

NRC Information Notice No. 86-106, *Feedwater Line Break*, December 16, 1986.

NRC Information Notice No. 86-106, Supplement 1, *Feedwater Line Break*, February 13, 1987.

NRC Information Notice No. 86-106, Supplement 2, *Feedwater Line Break*, March 18, 1987.

NRC Information Notice No. 86-106, Supplement 3, *Feedwater Line Break*, November 10, 1988.

NRC Information Notice 86–108, Supplement 3, *Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion*, January 5, 1995.

NRC Information Notice 87-28, *Air System Problems in US Light Water Reactors*, June 22, 1987; Supplement 1, December 28, 1987.

NRC Information Notice 87-36, *Significant Unexpected Erosion of Feedwater Lines*, August 4, 1987.

NRC Information Notice 87-43, *Gaps in Neutron-Absorbing Material in High-Density Spent Fuel Storage Racks*, September 8, 1987.

NRC Information Notice 87-67, *Lessons Learned from Regional Inspections of Licensee Actions in Response to I & E Bulletin 80-11*, December 31, 1987.

NRC Information Notice 88-01, *Safety –Injection Pipe Failure*, January 27, 1988.

NRC Information Notice 88-17, *Summary and Response to NRC Bulletin 87-01 "Thinning of Pipe Walls in Nuclear Power Plants"*, April 22, 1988.

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

NRC Information Notice 90-29, *Cracking of Cladding and its Heat–Affected Zone in the Base Metal of a Reactor Vessel Head*, April 30, 1990.

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

NRC Information Notice 90-68, Supplement 1, *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 93-70, *Degradation of Boraflex Neutron Absorber Coupons*, September 10, 1993.

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

NRC Information Notice 94-58, *Reactor Coolant Pump Lube Oil Fire*, August 16, 1994.

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

NRC Information Notice 95-38, *Degradation of Boraflex Neutron Absorber in Spent Fuel Pool Storage Racks*, September 8, 1995.

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.

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

NRC 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*, March1978.

NRC Regulatory Guide 1.127, Revision 1, *Inspection of Water-Control Structures Associated with Nuclear Power Plants*, March 1978.

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-0612, *Control of Heavy Loads at Nuclear Power Plants*, 1980.

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.

NUREG-1557, *Summary of Technical information and Agreements from Nuclear Management and Resource Council Industry Reports Addressing License Renewal*, U.S. Nuclear Regulatory Commission, October 1996.

NUREG/CR-6001, *Aging Assessment of BWR Standby Liquid Control Systems*, G. D. Buckley, R. D. Orton, A. B. Johnson Jr., and L. L. Larson, 1992.

GALL REPORT – MECHANICAL DISCIPLINE COMMENTS
SECTION VII I

GALL SECTION	TITLE	ITEM NO.	PAGE	COMMENT
VII I-1	Liquid Waste Disposal System	I.1	VII I-4, & 8	External wetting could also be from treated and raw water systems. These need to be added to the Environment column.
VII I-2	Liquid Waste Disposal System	I.1	VII I-5, & 9	The Exiting Aging management column suggests that loss of material due to pitting corrosion and crevice corrosion could be managed by a chemistry program. We do not believe this is valid. BASIS: Once water leaves a system, the chemistry program no longer applies. Another program or a site-specific program needs to be presented to manage external aging.
VII I-3	Liquid Waste Disposal System	I.1	VII I-7	The program described here is a mixture of two programs. To manage loss of material due to boric acid wastage, the program described here needs to be replaced with the Boric Acid Corrosion Program description that has been provided. This is the only program required to manage boric acid wastage of carbon steel component external surfaces. In addition, another program or site specific activities need to be described here to manage loss of material due to general corrosion of external surfaces or general corrosion needs to be deleted from the Aging Mechanisms column.
VII I-4	Liquid Waste Disposal System	I.1, I.2, I.3, I.4, I.5, I.6, & I.7 on external surfaces	VII I-8 through 17	Delete Items I.1, I.2, I.3, I.4, I.5, I.6 and I.7 BASIS: Stainless steel is not susceptible to stress corrosion cracking when exposed to ambient air. Also, cracking of stainless steel external surfaces due to leakage from the system assumes a failure to identify an aging effect. Except for boric acid wastage of external surfaces, licensees don't assume a failure to identify an aging effect.
VII I-5	Liquid Waste Disposal System	I.1, I.2, I.3, I.4, I.5, I.6, & I.7	VII I-11, 13, 15, & 17	Replace the wording in the Existing Aging management Program and Evaluation and Technical Basis columns with a reference to the Primary Water chemistry program. BASIS: To manage stress corrosion cracking, all that is needed is the Chemistry Program (Primary).