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May 22, 1996

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Request for Review and Approval of License Renewal IPA System and Commodity Reports

REFERENCES:

(a) Letter from Mr. R. E. Denton (BGE) to NRC Document Control Desk, dated August 18, 1995, "Integrated Plant Assessment Methodology"

(b) Letter from Mr. D. M. Crutchfield (NRC) to Mr. C. H. Cruse (BGE), dated April 8, 1996, "Final Safety Evaluation (FSE) Concerning The Baltimore Gas and Electric Company Report entitled, Integrated Plant Assessment Methodology"

(c) Letter from Mr. S. F. Newberry (NRC) to Mr. C. H. Cruse (BGE), dated April 15, 1996, "License Renewal Demonstration Program Site Visit, Calvert Cliffs Nuclear Power Plant Trip Report"

This letter forwards the first five Integrated Plant Assessment (IPA) System and Commodity Reports for review and approval in accordance with 10 CFR Part 54, the license renewal rule. Should we apply for License Renewal, we will reference IPA System and Commodity Reports as meeting the requirements of 10 CFR 54.21(a), "Contents of application-technical information," and the demonstration required by 10 CFR 54.29(a)(1), "Standards for issuance of a renewed license."

In Reference (a), Baltimore Gas and Electric Company submitted the IPA Methodology for review and approval. In Reference (b), the Nuclear Regulatory Commission (NRC) concluded that the IPA Methodology is acceptable for meeting 10 CFR 54.21(a)(2) of the license renewal rule, and if implemented, provides reasonable assurance that all structures and components subject to an aging management review pursuant to 10 CFR 54.21(a)(1) will be identified. Additionally, the NRC concluded that the methodology provides processes for demonstrating that the effects of aging will be adequately

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managed pursuant to 10 CFR 54.21(a)(3) that are conceptually sound and consistent with the intent of the license renewal rule.

As part of the Nuclear Energy Institute (NEI) Demonstration Project, the NRC visited the Calvert Cliffs Nuclear Power Plant site and reviewed sample license renewal results. In Reference (c), the NRC forwarded their report of observation of Baltimore Gas and Electric Company's implementation of NEI 95-10, Revision 0 "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule." In both References (b) and (c), we received comments regarding the level of detail in our IPA System and Commodity Reports.

We believe that resolution of the appropriate level of detail to be included in a license renewal application is an important element of assuring that renewing one's operating license remains both a stable and achievable option. After holding discussions with NRC Staff, we believe that this open issue will be most efficiently reached by working through a review of actual results from our IPA Methodology. We propose that in parallel with reviewing our IPA System and Commodity Reports, supplemented by the enclosed Aging Management Reports for background information, that the level of detail for format and content of a license renewal application be developed. We will propose an action plan to do this at our May 22, 1996 meeting.

We will submit revised IPA System and Commodity Reports for these initial five systems after the format and content issue is clarified. All future IPA System and Commodity Reports submitted for review will be based on the results of the agreed upon format and content.

There were other observations noted by the Staff in Reference (c) with respect to the implementation of NEI 95-10. We expect to resolve these items during the review of the enclosed reports.

Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

CHC/JMO/dlm

cc: **(Without Attachments/Enclosures)**
D. A. Brune, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
A. W. Dromerick, NRC
T. T. Martin, NRC
Resident Inspector, NRC
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R. I. McLean, DNR
J. H. Walter, PSC
T. Tipton, NEI

(With Attachments/Enclosures)
S. C. Flanders, NRC

Attachments: (1) Appendix A, Technical Information, 5.3.2 Diesel Fuel Oil System

Enclosure (1) - Diesel Fuel Oil System Aging Management Review Report, Revision 1

(2) Appendix A, Technical Information, 5.7 Other Fluid Systems, 5.7.1 Area and Process Radiation Monitoring

Enclosure (2) - Aging Management Review Results for the Area & Process Radiation Monitoring System, Revision 1

(3) Appendix A, Technical Information, 5.8 Feedwater System

Enclosure (3) - Main Feedwater System Aging Management Review Report, Revision 1

(4) Appendix A, Technical Information, 7.1 Class 1 Structures

Enclosure (4) - Aging Management Review Report for the Condensate Storage Tank No. 12 Enclosure, Revision 2

Enclosure (5) - Aging Management Review Report for the Fuel Oil Storage Tank No. 21 Enclosure, Revision 2

Enclosure (6) - Aging Management Review Report for the Turbine Building, Revision 2

Enclosure (7) - Aging Management Review Report for the Intake Structure, Revision 2

Enclosure (8) - Aging Management Review Report for the Auxiliary Building, Revision 2

Enclosure (9) - Aging Management Review Report for the Containment Structure, Revision 3

Enclosure (10) - Aging Management Review Report for the Containment System, Revision 1

(5) Appendix A, Technical Information, 7.6 Component Supports Commodity Evaluation

Enclosure (11) - Aging Management Review Report for Component Supports, Revision 2

5.3.2 Diesel Fuel Oil System

The Diesel Fuel Oil (DFO) System was scoped and the components requiring an aging management review (AMR) were identified in accordance with the process described in Section 2.0. The portion of the DFO System within the scope of license renewal includes the fuel oil storage tanks, the piping and components associated with the fuel oil unloading station, and the piping and components from the tanks to the strainer at the diesel generator fuel oil transfer pumps. Several component types are common to many plant systems and perform the same passive functions regardless of system. For efficiency, these are addressed separately as commodity groups and are not included in this section. These include cables, component supports, process instrument tubing and components, and components required for fire protection only. As a result of these activities, four DFO System component types were determined to require an AMR. A list of these component types is given in Table 5.3-1.

Table 5.3-3 provides a list of references for the DFO System License Renewal Application. This list includes both industry and site-specific documents.

Intended Functions

The DFO System provides a reliable supply of fuel oil to the emergency diesel generators, the auxiliary boilers, the station blackout diesel generator, and the diesel-driven fire pump. The UFSAR Section 8.4.1 discusses the DFO System.

The DFO System components subject to an AMR provide the following passive intended functions:

a. Piping, tanks and in-line components maintain the pressure boundary of the system.

b. Electrical cables, and associated equipment, maintain electrical continuity for electrical components and/or protect these components from electrical faults.

c. Component supports provide structural support for DFO equipment.

d. Certain DFO System equipment supports the fire protection function.

All components in the system that perform functions b., c., and d. listed above, and process instrument tubing and process instrument components that support function a., were addressed in commodity evaluations of cables, component supports, fire protection equipment, and instrumentation lines. Therefore, only the pressure retaining function for the component types listed in Table 5.3-1 is addressed in this section.

Results of Aging Management Review

The potential age related degradation mechanisms (ARDMs) for the DFO System are identified in Table 5.3-2. Based upon system/component operating environment and component design, a number of these mechanisms were removed from further evaluation. These mechanisms are identified by a check mark (✓) in the "Not Plausible for System" column of Table 5.3-2. The plausible ARDMs are also identified in Table 5.3-2 by a check mark (✓) in the appropriate column.

The following paragraphs provide the demonstration for each group of components subject to an AMR that the effects of the plausible aging identified in Table 5.3-2 are adequately managed such that there will be reasonable assurance that the intended function will be maintained consistent with the current licensing basis (CLB) during the period of extended operation.

Diesel Fuel Oil System Piping

The process fluid is fuel oil treated with a corrosion inhibitor and is not corrosive to the carbon steel piping materials. Water content of the fuel oil is kept to a minimum by periodic draining of the fuel oil storage tank sumps, and by fuel oil chemistry testing and control. System pipes take suction above the tank bottom, thereby minimizing carry of sludge into the pipes. Therefore, corrosion is not considered a plausible ARDM for the piping internal surfaces.

Aboveground carbon steel fuel oil piping not located in climate-controlled buildings may be exposed to moist or wet environments; therefore, crevice corrosion, general corrosion, and pitting are plausible for the external surfaces of these pipes. External surfaces of aboveground piping are covered by protective coatings. The aging management for external surfaces of the piping consists of activities performed to preserve the protective coating. Discovery of degraded protective coatings is accomplished as described in the IPA Methodology, including periodic documented inspections by assigned system engineers. Evaluation of degraded conditions, corrective action and follow-up activities are controlled by the existing plant programs for maintaining protective coatings. By maintaining coatings on external surfaces of the piping, unchecked corrosion of the external surfaces will be prevented.

For buried piping, soil conditions could lead to corrosion of the carbon steel piping external surfaces if appropriate measures are not taken. The piping is protected by a barrier wrap and an impressed current cathodic protection system. However, buried portions of the fuel oil system piping cannot be readily inspected. Therefore, to provide additional assurance that the effects of corrosion will not prevent the performance of the intended function of the DFO buried piping, this piping will be included in a program which inspects exterior surfaces of buried DFO piping.

The discussion above demonstrates that the cited programs and inspections will manage age-related degradation such that the DFO piping will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

Check Valves and Hand Valves

The process fluid is fuel oil treated with a corrosion inhibitor and is not corrosive to the carbon steel valve body materials. Water content of the fuel oil is kept to a minimum by periodic draining of the fuel oil storage tank sumps, and by fuel oil chemistry testing and control. System pipes take suction above the tank bottom, thereby minimizing carry of sludge into the pipes. Therefore, corrosion is not considered a plausible ARDM for the internal surfaces of the carbon steel check valves and hand valves.

The external surfaces of the carbon steel valves not located in climate-controlled buildings may be exposed to moist or wet environments, therefore; crevice corrosion, general corrosion, and pitting are plausible for the external surfaces of these valves. External surfaces of valves are covered by protective coatings. The aging management for external surfaces of the valves consists of activities performed to preserve the protective coating. Discovery of degraded protective coatings is accomplished as described in the IPA Methodology, including periodic documented inspections by assigned system engineers. Evaluation of degraded conditions, corrective action and follow-up activities are controlled by the existing plant programs for maintaining protective coatings. By maintaining coatings on external surfaces of the valves, unchecked corrosion of the external surfaces will be prevented.

The discussion above demonstrates that the cited programs and inspections will manage age-related degradation such that the DFO check valves and hand valves will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

Fuel Oil Storage Tanks

Tank Internal Surfaces: Fuel/water interfaces may be present inside the carbon steel fuel oil storage tanks; therefore, crevice corrosion, general corrosion, pitting, fouling and microbiologically influenced corrosion (MIC) are considered plausible ARDMs for the internal surfaces. Current plant programs require that water collecting in the bottom of the fuel oil storage tank be drained periodically. In addition, existing plant procedures control fuel oil chemistry, including sampling for the presence of biologics and water, and the addition of a corrosion inhibitor to delivered fuel. The effects of crevice and general corrosion, pitting, MIC, and fouling are minimized by: (1) limiting the amount of water allowed to accumulate in the tank; (2) controlling fuel oil chemistry; and (3) monitoring for the presence of biologics. To provide additional assurance that these aging effects will not prevent the performance of the tank intended function, tank internal inspections will be performed at intervals based on previous inspection results to identify and evaluate any aging effects within the tanks.

Tank Bottom External Surfaces: Design features[1] and plant-specific tank inspection results support the conclusion that age related degradation of the external surface of the tank bottom is not plausible. Due to environmental concerns for any fuel oil leakage that have arisen from petroleum tank experience, confirmatory inspections for aging effects will be conducted prior to the period of extended operation to support this conclusion.

Tank Accessible External Surfaces: External surfaces of tanks are covered by protective coatings. The aging management for accessible external surfaces consists of activities performed to preserve the protective coating. Discovery of degraded protective coatings is accomplished as described in the IPA Methodology, including periodic documented inspections by assigned system engineers. Evaluation of degraded conditions, corrective action and follow-

1 The tank bottoms are coated with a material which provides galvanic protection, bottom seams are covered by protective asbestos strips, the tanks are protected by the cathodic protection system, the tank bottoms sit on three inches of oiled and compacted sand, the tanks are above the groundwater table, and the tank perimeters are sealed to prevent water from getting underneath.

up activities are controlled by the existing plant programs for maintaining protective coatings. By maintaining coatings on accessible external surfaces of the tanks, unchecked corrosion will be prevented.

The discussion above demonstrates that the cited programs and inspections will manage age-related degradation such that the fuel oil storage tanks will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

TABLE 5.3-1

DFO SYSTEM COMPONENT TYPES REQUIRING AMR

Piping	Fuel Oil Storage Tanks
Hand Valves	Check Valves

TABLE 5.3-2

POTENTIAL AND PLAUSIBLE ARDMs FOR THE DFO SYSTEM

Potential ARDMs	Component Types for Which ARDM is Plausible				Not Plausible for System
	Piping	Check Valve	Hand Valve	Tank	
Cavitation Erosion					✓
Corrosion Fatigue					✓
Crevice Corrosion	✓	✓	✓	✓	
Erosion Corrosion					✓
Fatigue					✓
Fouling				✓	
Galvanic Corrosion					✓
General Corrosion	✓	✓	✓	✓	
Hydrogen Damage					✓
Intergranular Attack					✓
MIC	✓			✓	
Particulate Wear Erosion					✓
Pitting	✓	✓	✓	✓	
Radiation Damage					✓
Rubber Degradation					✓
Saline Water Attack					✓
Selective Leaching					✓
Stress Corrosion Cracking					✓
Stress Relaxation					✓
Thermal Damage					✓
Thermal Embrittlement					✓
Wear					✓

TABLE 5.3-3

LIST OF REFERENCES FOR THE DFO SYSTEM

1. Aging Management Review Report for the Diesel Fuel Oil System, Revision 1

2. Draft Regulatory Guide DG-1009, Standard Format and Content of Technical Information for Applications to Renew Nuclear Power Plant Operating Licenses, 1990

3. EPRI-NP-2129, Radiation Effects on Organic Materials in Nuclear Plants, 1981

4. EPRI-NP-3784, A Survey of the Literature on Low-Alloy Steel Fastener Corrosion in PWR Power Plants, 1984

5. EPRI-NP-3944, Erosion/Corrosion in Nuclear Plant Steam Piping, 1985

6. EPRI-NP-5461, Component Life Estimation: LWR Structural Materials Degradation Mechanisms, 1987

7. EPRI-NP-5769, Degradation and Failure of Bolting in Nuclear Power Plants, 1988

8. EPRI-NP-5775, Environmental Effects on Components: Commentary for ASME Section III, 1988

9. EPRI-NP-5985, Boric Acid Corrosion of Carbon and Low Alloy Steel Pressure Boundary Materials, 1988

10. NUREG/CR-5379, Nuclear Plant Service Water System Aging Degradation Assessment, Volume 1 - 1989, Volume 2 - 1992

11. NUREG/CR-5419, Aging Assessment of Instrument Air Systems, 1990

12. NUREG/CR-5643, Insights Gained from Aging Research, 1992

13. EPRI-TR-102204, Service (Salt) Water System Life Cycle Management Evaluation, 1993

14. EPRI-NP-3137, Computer-Calculated Potential pH Diagrams to 300°C, Volume 1, 1983

15. Licensee Event Report 89-26, Potential Emergency Diesel Generator Failure Due to High Particulate Level in Fuel, 1989

5.7.1 Area and Process Radiation Monitoring

The Area and Process Radiation Monitoring System (RMS) was scoped and the components requiring an aging management review (AMR) were identified in accordance with the process described in Section 2.0. The portion of the RMS within the scope of license renewal includes components associated with the following radiation monitors:

- Wide range effluent gas radiation monitors
- Containment atmosphere radiation monitors containment penetration piping and valves
- Containment area radiation monitors
- Containment high range radiation monitors
- Main steam line effluent radiation monitors
- Service water radiation monitors
- Component cooling radiation monitors
- Control room ventilation radiation monitors

Several component types are common to many plant systems and perform the same passive intended functions regardless of system. For efficiency, these are addressed separately as commodity groups and are not included in this section. These include cables, component supports, and process instrument tubing and process instrument components. In addition, the results of the AMR for some of the components associated with the Control Room Ventilation, Service Water, and Component Cooling radiation monitors are included in the sections of the license renewal application for the monitored system.

As a result of these activities, 11 Area and Process Radiation Monitoring component types were determined to require an AMR. A list of these component types is given in Table 5.7-1.

Table 5.7-3 provides a list of references that were used for this License Renewal Application Section. This list includes both industry and site-specific documents.

Intended Functions

The purpose of the RMS is to warn operations personnel of increasing radiation levels or an abnormal radioactivity concentration at selected locations in the plant. The RMS may also indicate system or component malfunctions that require operator action or may perform automatic protective actions to correct and/or isolate an abnormal condition to prevent an uncontrolled release of radioactive material to the environment. Updated Final Safety Analysis Report Sections 7.5.6, 11.2.3 and Figure 11-4 address the RMS.

The RMS components subject to AMR provide the following passive intended functions:

a. System piping and in-line components maintain the pressure boundary of the system.

b. Piping and valves associated with the containment atmosphere radiation monitors provide containment isolation.

c. Cabling maintains electrical continuity to RMS electrical components and/or provides protection of these components from faults.

d. Component supports provide structural support to RMS components.

All components in the system which perform function c. and d. above, and process instrument tubing and process instrument components that supports function a., were addressed in commodity evaluations. Therefore, only the pressure retaining and containment isolation functions for the component types listed in Table 5.7-1 are addressed in this Section.

Results of Aging Management Review

The potential age-related degradation mechanisms (ARDMs) for the RMS are identified in Table 5.7-2. Based upon system/component operating environment and component design, a number of these mechanisms were removed from further evaluation. These mechanisms are identified by a check mark (✓) in the "Not Plausible for System" column of Table 5.7-2. The plausible ARDMs are also identified in Table 5.7-2 by a check mark (✓) in the appropriate column. Where no plausible age-related degradation was identified for a device type, no aging management is required.

For device types with identified plausible ARDMs, the following discussion provides the demonstration that the effects of the plausible aging are adequately managed such that there will be reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

RMS Piping

Table 5.7-2 lists the ARDMs considered to be plausible for the carbon steel containment atmosphere radiation monitors containment penetration piping.

Crevice corrosion, general corrosion, and pitting due to the air internal environment of the containment atmosphere radiation monitor penetration piping are not expected to result in rapid degradation of the pressure boundary. However, to provide additional assurance that the effects of corrosion will not prevent the performance of the intended function of the containment penetration piping, this piping will be included in the population of piping that will be subject to an age-related degradation inspection as described in the Integrated Plant Assessment (IPA) Methodology.

The discussion above demonstrates that the cited inspection will manage aging such that the RMS penetration piping will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

Control Valves

Table 5.7-2 lists the ARDM considered to be plausible for the stainless steel containment atmosphere radiation monitors containment penetration control valves.

Wear of the seating surfaces of the containment penetration control valves in the RMS is plausible. Wear of the seating surfaces can be adequately managed by local leak rate testing, performed in accordance with Appendix J to 10 CFR Part 50.

The discussion above demonstrates that the cited program will manage the age-related degradation such that the RMS penetration control valves will continue to be capable of performing the containment isolation function under all design conditions required by the CLB.

Hand Valves

Crevice corrosion, general corrosion, and pitting are plausible for the carbon steel containment atmosphere radiation monitors containment penetration test connection hand valves. Corrosion due to the air internal environment is not expected to result in rapid degradation of the pressure boundary. However, to provide additional assurance that the effects of corrosion will not prevent the performance of the pressure retaining intended function of these hand valves, these components will be included in the population of components that will be subject to an age-related degradation inspection as described in the IPA Methodology.

Crevice corrosion, general corrosion, and pitting are plausible for carbon steel service water and component cooling water radiation monitor hand valves. The internal environment of these valves is treated water. Controlling water chemistry, through the current Service Water and Component Cooling System Chemistry Control Program, provides an environment which limits the effects and rate of degradation caused by corrosion mechanisms. However, to provide additional assurance that the effects of corrosion will not prevent the performance of the intended function of these hand valves, these components will be included in the population of components that will be subject to an age-related degradation inspection as described in the IPA Methodology.

The discussion above demonstrates that the cited programs will manage the age-related degradation such that the RMS hand valves will continue to be capable of performing the intended functions under all design conditions required by the CLB.

TABLE 5.7-1

AREA AND PROCESS RADIATION MONITORING SYSTEM COMPONENT TYPES REQUIRING AMR

- Piping
- Control Valves
- Hand Valves
- Solenoid Valves
- Flow Indicators
- Check Valves
- Motor-Operated Valves
- Filters
- Radiation Test Points
- Flow Elements
- Radiation Elements

TABLE 5.7-2

POTENTIAL AND PLAUSIBLE ARDMs

Potential ARDMs	Component Types for Which ARDM is Plausible											Not Plausible for System
	Piping	Check Valve	Control Valve	Hand Valve	Motor-Operated Valve	Flow Element	Flow Indicator	Radiation Element	Filter	Radiation Test Point	Solenoid Valve	
Cavitation Erosion												✓
Corrosion Fatigue												✓
Crevice Corrosion	✓			✓								
Erosion Corrosion												✓
Fatigue												✓
Fouling												✓
Galvanic Corrosion												✓
General Corrosion	✓			✓								
Hydrogen Damage												✓
Intergranular Attack												✓
MIC												✓
Particulate Wear Erosion												✓
Pitting	✓			✓								
Radiation Damage												✓
Rubber Degradation												✓
Saline Water Attack												✓
Selective Leaching												✓
Stress Corrosion Cracking												✓
Stress Relaxation												✓
Thermal Damage												✓
Thermal Embrittlement												✓
Wear			✓									

TABLE 5.7-3

LIST OF REFERENCES FOR THE AREA AND PROCESS RADIATION MONITORING SYSTEM

1. Aging Management Review Report for the Area and Process Radiation Monitoring System, Revision 1
2. Draft Regulatory Guide DG-1009, Standard Format and Content of Technical Information for Applications to Renew Nuclear Power Plant Operating Licenses, 1990
3. EPRI-NP-2129, Radiation Effects on Organic Materials in Nuclear Plants, 1981
4. EPRI-NP-3784, A Survey of the Literature on Low-Alloy Steel Fastener Corrosion in PWR Power Plants, 1984
5. EPRI-NP-3944, Erosion/Corrosion in Nuclear Plant Steam Piping, 1985
6. EPRI-NP-5461, Component Life Estimation: LWR Structural Materials Degradation Mechanisms, 1987
7. EPRI-NP-5769, Degradation and Failure of Bolting in Nuclear Power Plants, 1988
8. EPRI-NP-5775, Environmental Effects on Components: Commentary for ASME Section III, 1988
9. EPRI-NP-5985, Boric Acid Corrosion of Carbon and Low Alloy Steel Pressure Boundary Materials, 1988
10. NUREG/CR-5379, Nuclear Plant Service Water System Aging Degradation Assessment, Volume 1 - 1989, Volume 2 - 1992
11. NUREG/CR-5419, Aging Assessment of Instrument Air Systems, 1990
12. NUREG/CR-5643, Insights Gained from Aging Research, 1992
13. INPO O&MR-132, "Particulate and Gaseous Radioactivity Monitoring System Failures Due to Excess Moisture", Operations and Maintenance Reminder, INPO, 1983
14. EPRI-TR-102204, Service (Salt) Water System Life Cycle Management Evaluation, 1993

5.8 Feedwater System

The Feedwater System was scoped and the components requiring an Aging Management Review (AMR) were identified in accordance with the process described in Section 2.0. The portion of the Feedwater System within the scope of license renewal includes the piping, components and valves from the feedwater isolation motor-operated valves (MOVs) to the steam generator nozzle. Also included are steam generator secondary side water level and pressure instrumentation loops, including the root isolation valves and all downstream components (valves, tubing, instruments). Several component types are common to many plant systems and perform the same passive intended functions. For efficiency, these are addressed separately as commodity groups and are not included in this section. These include cables, component supports, and process instrument tubing and components. As a result of these activities, five Feedwater System component types were determined to require an AMR. A list of these components types is shown in Table 5.8-1.

Table 5.8-3 provides a list of references for the Feedwater System License Renewal Application. This list includes both industry and site-specific documents.

Intended Functions

The Feedwater System (in conjunction with the Condensate System) provides a means for transferring condensate from the condenser hotwell to the steam generators, and also provides a means for controlling the quantity of feedwater to the steam generators. Updated Final Safety Analysis Report Section 10.2 discusses the Feedwater System, and UFSAR Figures 10-4 and 10-11 depict the Unit 1 and Unit 2 Feedwater Systems, respectively.

The Feedwater System components subject to an AMR have the following passive intended functions:

a. Piping and in-line components maintain the pressure boundary of the system.

b. Electrical cables, and associated equipment maintain electrical continuity for feedwater electrical components and/or provide protection of the components from electrical faults.

c. Component supports provide structural support for feedwater components.

All components in the system which perform the second and third intended function listed above, and process instrument tubing and process instrument components which support the first function, were addressed in commodity evaluations of cables, component supports and instrument lines. Therefore, only the pressure retaining function for the component types listed in Table 5.8.1 is addressed in this Section.

Results of the Aging Management Review

The potential degradation mechanisms for the Feedwater System are identified in Table 5.8-2. Based upon system/component environment and component design, a number of these mechanisms were removed from further evaluation. These mechanisms are identified by a check mark (✓) in the "Not Plausible for System" column in Table 5.8-2. The plausible Age-Related Degradation Mechanisms (ARDMs) are also identified in Table 5.8-2 by a check mark (✓) in the appropriate column. The following paragraphs provide the demonstration for each group of components subject to an AMR that the effects of the plausible aging identified in Table 5.8-2 are adequately managed such that there will be reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operations.

Feedwater System Piping

Table 5.8-2 lists the ARDMs considered to be plausible for the carbon steel Feedwater System piping from the downstream side of the Feedwater isolation MOVs to the steam generators.

The Fatigue Monitoring Program (FMP) at Calvert Cliffs tracks fatigue cycles versus an allowed number of cycles for selected plant systems, and calculates cumulative usage factors for limiting locations in those systems. An evaluation will be performed for the portions of the Feedwater System in-scope piping that are subject to thermal fatigue in order to determine whether the effects of fatigue on this piping are bounded by components currently within the scope of the FMP. If the piping is bounded, the effects of fatigue are managed by the FMP. If the piping is not bounded, the FMP will be modified to include the Feedwater System piping or other bounding components in order to manage the effects of thermal fatigue.

In addition, various corrosion mechanisms are adequately managed as described in the paragraphs below. The combination of secondary water chemistry control to address corrosion, and the activities to manage fatigue, address the synergistic effects of these mechanisms (i.e., corrosion fatigue).

Controlling the environment to which the piping materials are exposed by controlling secondary water chemistry is effective in limiting crevice corrosion and pitting. Because of secondary water chemistry control, the occurrence of these localized types of corrosion is expected to be limited and the propagation rate is expected to be slow. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the feedwater piping, this piping will be included in the population of piping which will be subjected to an age-related degradation inspection as described in the Integrated Plant Assessment (IPA) Methodology.

Controls on secondary water chemistry provide an environment which limits the rate of degradation due to erosion corrosion. In addition, current plant procedures which institute erosion corrosion monitoring, check the wall thickness of Feedwater System piping at locations determined to be the most susceptible to erosion corrosion.

Controlling secondary water chemistry provides an environment which limits the rate and effects of degradation caused by general corrosion. Thus, only a minimal amount of general corrosion is expected to result. Additionally, the current plant procedure which monitors for the effects of erosion corrosion will also adequately manage the effects of general corrosion for the piping segments which are monitored for erosion corrosion. However, to provide additional assurance that the effects of general corrosion will not prevent the performance of the intended function of the feedwater piping in areas of the piping not managed by the erosion corrosion program, this piping will be included in the population of piping which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Thus, the discussion above demonstrates that the cited programs will manage the aging such that the Feedwater System piping will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

Steam Generator Feedwater Header Check Valves

Table 5.8-2 lists the ARDMs considered to be plausible for carbon steel steam generator feedwater header check valves.

The Fatigue Monitoring Program at Calvert Cliffs tracks fatigue cycles versus an allowed number of cycles for selected plant systems and calculates cumulative usage factors for limiting locations in those systems. An evaluation will be performed for the check valves in order to determine whether the effects of fatigue on these components is bounded by components currently within the scope of the Fatigue Monitoring Program (FMP). If the check valves are bounded, the effects of fatigue are managed by the FMP. If the check valves are not bounded, the FMP will be modified to include the check valves or other bounding components in order to manage the effects of thermal fatigue.

In addition, various corrosion mechanisms are adequately managed as described in the paragraphs below. The combination of secondary water chemistry control to address corrosion, and the activities to manage fatigue, address the synergistic effects of these mechanisms (i.e., corrosion fatigue).

Controlling the environment to which the check valve materials are exposed by controlling secondary water chemistry is effective in limiting the rate of crevice corrosion and pitting. Because of secondary water chemistry control, the occurrence of these localized types of corrosion is expected to be limited and the propagation rate is expected to be slow. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the feedwater check valves, these valves will be included in the population of valves which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Controls on secondary water chemistry provide an environment which limits the rate of degradation due to erosion corrosion. Inspections will be performed for steam generator inlet check valves in order to assess, and monitor if necessary, the effects of erosion corrosion.

Controlling secondary water chemistry provides an environment which limits the rate and effects of degradation caused by general corrosion. Thus, only a minimal amount of general corrosion is expected to result. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the feedwater check valves, these valves will be included in the population of valves which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Thus, the discussion above demonstrates that the cited programs will manage the aging such that the steam generator feedwater header check valves will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

Feedwater Piping Drain and Steam Generator Instrumentation Root Isolation Hand Valves

Table 5.8-2 lists the ARDMs considered to be plausible for the Feedwater System carbon steel drain and instrument root isolation hand valves.

Controlling the environment to which the piping materials are exposed by controlling secondary water chemistry is effective in limiting the effects of crevice corrosion and pitting. Because of secondary water chemistry control, the occurrence of these localized types of corrosion is expected to be limited and the propagation rate is expected to be slow. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the these hand valves, they will be included in the population of valves which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Controlling secondary water chemistry provides an environment which limits the rate and effects of degradation caused by general corrosion. Thus, only a minimal amount of general corrosion is expected to result. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of these hand valves, they will be included in the population of valves which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Thus, the discussion above demonstrates that the cited programs will manage the aging such that the feedwater piping drain and steam generator instrumentation root isolation hand valves will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

Feedwater Isolation Motor-Operated Valves

Table 5.8-2 lists the ARDMs considered to be plausible for carbon steel feedwater isolation MOVs.

Controlling the environment to which the MOV materials are exposed by controlling secondary water chemistry is effective in limiting crevice corrosion and pitting. Because of secondary water chemistry control, the occurrence of these localized types of corrosion is expected to be limited and the propagation rate is expected to be slow. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the feedwater MOVs, these valves will be included in the population of valves which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Controls on secondary water chemistry provide an environment which limits the rate of degradation due to erosion corrosion. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the feedwater MOVs, these valves will be included in the population of valves which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Controlling secondary water chemistry provides an environment which limits the rate and effects of degradation caused by general corrosion. Thus, only a minimal amount of general corrosion is expected to result. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the feedwater MOVs, these valves will be included in the population of valves which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Thus, the discussion above demonstrates that the cited programs will manage the aging such that the feedwater isolation MOVs will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

Feedwater Temperature Element Thermowell

Table 5.8-2 lists the ARDMs considered to be plausible for feedwater temperature element thermowells fabricated from a Chrom-Moly low alloy.

Controlling the environment (e.g., by controlling secondary water chemistry) is effective in limiting crevice corrosion and pitting. Because of secondary water chemistry control, the propagation rate of these localized types of corrosion is expected to be slow. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the thermowells, they will be included in the population of components which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Because of secondary water chemistry control and the thermowell material of construction, the propagation rate of erosion corrosion is expected to be slow. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the thermowells, they will be included in the population of components which will be subjected to an age-related degradation inspection as described in the IPA Methodology

Controlling secondary water chemistry provides an environment which limits the rate and effects of degradation caused by general corrosion. Thus, only a minimal amount of general corrosion is expected to result. However, to provide additional assurance that these aging effects will not prevent the performance of the intended function of the thermowells, they will be included in the population of components which will be subjected to an age-related degradation inspection as described in the IPA Methodology.

Thus, the discussion above demonstrates that the cited programs will manage the aging such that the feedwater temperature element thermowells will continue to be capable of performing the pressure boundary function under all design conditions required by the CLB.

TABLE 5.8-1

FEEDWATER SYSTEM COMPONENTS TYPES REQUIRING AMR

Piping
Hand Valves
Motor-Operated Valves
Temperature Elements
Check Valves

TABLE 5.8-2

POTENTIAL AND PLAUSIBLE ARDMs

Potential ARDMs	Component Types for Which ARDM Is Plausible					Not Plausible for System
	Piping	Check Valve	Hand Valve	MOV	Temperature Element	
Cavitation Erosion						✓
Contamination/Sediment						✓
Corrosion Fatigue	✓	✓				
Crevice Corrosion	✓	✓	✓	✓	✓	
Dynamic Loading						✓
Electrical Stressors						✓
Erosion Corrosion	✓	✓		✓	✓	
Fatigue	✓	✓				
Galvanic Corrosion						✓
General Corrosion	✓	✓	✓	✓	✓	
Hydrogen Damage						✓
Intergranular Attack						✓
MIC						✓
Particulate Wear Erosion						✓
Pitting	✓	✓	✓	✓	✓	
Radiation Damage						✓
Saline Water Attack						✓
Selective Leaching						✓
Stress Corrosion Cracking						✓
Thermal Damage						✓
Thermal Embrittlement						✓
Wear						✓

TABLE 5.8-3

LIST OF REFERENCES FOR THE FEEDWATER SYSTEM

1. NUREG/CR-4234, Volume 1, Aging and Service Wear Of Electric Motor-Operated Valves Used in Engineering Safety Feature Systems Of Nuclear Power Plants, June 1, 1985
2. NUREG/CR-5379, Nuclear Plant Service Water System Aging Degradation Assessment, Phase I, June 1989
3. NUREG/CR-5419, Aging Assessment of Instrument Air Systems, January 1990
4. NUREG/CR-5643, Insights Gained from Aging Research, March 1992
5. EPRI-NP-1558, A Review of Equipment Aging Theory and Technology, September 1980
6. EPRI-NP-2129, Radiation Effects on Organic Materials in Nuclear Plants, November 1981
7. EPRI-NP-3944, Erosion/Corrosion in Nuclear Plant Steam Piping, April 1985
8. EPRI-NP-5461, Component Life Estimation: LWR Structural Materials Degradation Mechanisms, 1987
9. EPRI-NP-5775, Environmental Effects on Components: Commentary for ASME Section III, April 1988
10. EPRI-NP-5985, Boric Acid Corrosion of Carbon and Low Alloy Steel Pressure Boundaries, 1988
11. EPRI-NP-6815D, Detection and Control of MIC, 1990
12. EPRI-TR-102204 Service (Salt) Water System Life Cycle Management Evaluation, April 1993
13. Draft Regulatory Guide DG-1009, Standard Format and Content of Technical Information for Applications to Renew Nuclear Power Plants, Appendix A, Draft, December 1990
14. Feedwater Aging Management Review Report, Revision 0, dated August 28, 1995

7.1 Seismic Category I Structures

Seismic Category I structures were scoped and structural components requiring an aging management review (AMR) were identified in accordance with the process described in Section 2.0. (This category is referred to as Class 1 in the methodology.) As a result of that process, the following structures within the scope of license renewal were identified at the CCNPP site:

- Containment Structure
- Auxiliary Building
- Intake Structure
- Turbine Building
- No. 21 Fuel Oil Storage Tank (FOST) Enclosure
- No. 12 Condensate Storage Tank (CST) Enclosure

The scope of structures was further divided into five structural component groups:

1. Concrete Components,
2. Structural Steel Components,
3. Architectural Components,
4. Unique Components, and
5. System Type Components.

Within those five structural component groups, 59 different structural component types were identified as contributing to the intended functions of the structure. A table listing these component types and indicating the structures to which the component types are applicable is given as Table 7.1-1.

Several structural component types are common to many plant systems and perform the same passive intended functions, (e.g., piping and component supports.) As described in Section 2.0, these are addressed separately as commodity groups and are not included in this section.

TABLE 7.1-1

STRUCTURAL COMPONENT TYPES REQUIRING AMR

Concrete (Including Reinforcing Steel)	Containment	Auxiliary Building	Intake Structure	Turbine Building	No. 21 FOST Enclosure	No. 12 CST Enclosure
Foundations (Footings, beams, and mats)		✓	✓		✓	✓
Columns	✓	✓	✓			
Walls		✓	✓	✓	✓	✓
Beams	✓	✓	✓			
Ground Floor Slabs/Equipment Pads	✓	✓	✓	✓		
Elevated Floor Slabs	✓	✓	✓	✓		
Roof Slabs		✓	✓		✓	✓
Cast-In-Place Anchors/Embedments •	✓	✓	✓	✓	✓	✓
Ductbanks				✓		
Grout	✓	✓	✓	✓	✓	✓
Concrete Blocks (Shielding)		✓				
Fluid Retaining Walls and Slabs		✓	✓	✓		
Masonry Block Walls		✓				
Post-Installed Anchors•	✓	✓	✓	✓	✓	
Structural Steel						
Columns•	✓	✓				
Beams•	✓	✓	✓	✓	✓	✓
Baseplates•	✓	✓	✓	✓	✓	✓
Floor Framing•	✓	✓	✓	✓		
Roof Framing•		✓	✓		✓	✓
Roof Trusses•		✓				
Bracing•	✓	✓	✓	✓	✓	
Removable Missile Shield	✓					
Platform Hangers•	✓	✓	✓	✓	✓	
Decking•	✓	✓	✓	✓	✓	✓
Jet Impingement• Barriers		✓		✓		

TABLE 7.1-1 (Continued)

STRUCTURAL COMPONENT TYPES REQUIRING AMR

Structural Steel	Containment	Auxiliary Building	Intake Structure	Turbine Building	No. 21 FOST Enclosure	No. 12 CST Enclosure
Liners	✓	✓				
Floor Grating•	✓		✓	✓	✓	
Checkered Plates•	✓		✓			
Stairs and Ladders•			✓	✓	✓	
Architectural Components						
Building Siding Clips•				✓		
Fire Doors, Jambs, and Hardware•		✓	✓	✓		
Access Doors, Jambs, and Hardware•		✓	✓	✓		
Caulking and Sealants		✓	✓	✓	✓	✓
Coatings (including galvanizing)	✓					
Unique Components						
Concrete Basemat	✓					
Concrete Dome	✓					
Concrete Containment Walls	✓					
Primary/Secondary Shield Wall	✓					
Refueling Pool Concrete	✓					
Post Tensioning System	✓					
Crane Girder•	✓					
Lubrite Plates•	✓					
Maranite XL Board	✓					
New Fuel Rack Assembly•		✓				
Spent Fuel Storage Racks		✓				
Monorail•		✓				
Cask Handling Crane Rail/Supports•		✓				
Lead Brick Shielding		✓				

TABLE 7.1-1 (Continued)

STRUCTURAL COMPONENT TYPES REQUIRING AMR

Unique Components	Containment	Auxiliary Building	Intake Structure	Turbine Building	No. 21 FOST Enclosure	No. 12 CST Enclosure
Pipe Whip Restraints*		✓				
Roll-Up Doors*		✓				
Expansion Joints		✓				
Watertight Doors*		✓	✓	✓		
Sluice Gates*			✓			
Anchor Brackets*					✓	
System Type Components						
Electrical Penetrations (Non-EQ)	✓					
Mechanical Penetrations	✓					
Fuel Transfer Tube/ Bellows	✓					
Personnel Airlocks	✓					
Equipment Hatch	✓					

* Indicates that component type is included under the heading "Structural Steel Components" in the discussion addressing the results of the AMR and in Table 7.1-3.

Intended Functions

As stated in Section 2.0, structures are within the scope of license renewal because they perform one or more of the eight structural intended functions. These functions and the structures which perform them are shown in Table 7.1-2.

TABLE 7.1-2
INTENDED FUNCTIONS OF SEISMIC CATEGORY I STRUCTURES

	Structures					
Function	Containment	Auxiliary Building	Intake Structure	Turbine Building	No. 21 FOST Enclosure	No. 12 CST Enclosure
1. Provide structural and/or functional support to safety-related equipment	✓	✓	✓	✓	✓	✓
2. Provide shelter/protection to safety-related equipment. (This function includes radiation protection for EQ equipment and high energy line break-related protection equipment.)	✓	✓	✓	✓	✓	✓
3. Serve as a pressure boundary or a fission product retention barrier to protect public health and safety in the event of any postulated DBEs	✓	✓				
4. Serve as a missile barrier (internal or external)	✓	✓	✓	✓	✓	✓
5. Provide structural and/or functional support to NSR equipment whose failure could directly prevent satisfactory accomplishment of any of the required safety-related functions (Example: seismic Category II over I design considerations)	✓	✓	✓	✓	✓	
6. Provide flood protection barrier (internal flooding event)	✓	✓	✓	✓		
7. Provide a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant	✓	✓	✓	✓		
8. Maintain the functionality of electrical components addressed by the EQ program.	✓					

While the first seven functions are of a structural nature, the eighth function is a system-type function and is provided by the EQ electrical penetrations, which are addressed in the commodity evaluation of EQ equipment.

Results of the Aging Management Review for Seismic Category I Structures

The potential age-related degradation mechanisms (ARDMs) for Seismic Category I structures are identified in Table 7.1-3 by listing their structure reference number in the "Potential" column. Based upon component/structure environment, design and the results of inspection, a number of these mechanisms were removed from further evaluation. The plausible age-related degradation mechanisms are also identified in Table 7.1-3 by listing their structure reference number in the "Plausible" column. Where no plausible age-related degradation was identified for a component type, no aging management is required.

TABLE 7.1-3
SEISMIC CATEGORY I STRUCTURES POTENTIAL AND PLAUSIBLE ARDMs

ARDM	Potential	Plausible	Components Affected
Structural Type Components (Concrete, Structural Steel, Architectural, Unique)			
Freeze-Thaw	1, 2, 3, 5, 6	N/A	N/A
Leaching of Calcium Hydroxide	1, 2, 3, 4, 5, 6	N/A	N/A
Aggressive Chemical Attack on Concrete	1, 2, 3, 4, 5, 6	1, 2, 3, 4	Ground Floor/Slabs, Basemats, Foundations, and Walls (below grade portions only); Intake Structure Fluid Retaining Walls and Slabs
Reactions with Aggregates	1, 2, 3, 4, 5, 6	N/A	N/A
Corrosion of Embedded Steel/Rebar	1, 2, 3, 4, 5, 6	1, 2, 3, 4	Ground Floor/Slabs, Basemats, Foundations, and Walls (below grade portions only); Intake Structure Fluid Retaining Walls and Slabs
Abrasion and Cavitation	3	N/A	N/A
Cracking of Masonry Block Walls	2	N/A	N/A
Settlement	1, 2, 3, 4, 5, 6	N/A	N/A
Corrosion of Steel	1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6	Structural Steel Components
Corrosion of Liner	1, 2	1, 2	Liners
Corrosion of Tendons	1	1	Post Tensioning System
Prestress Losses	1	1	Post Tensioning System
Weathering	1, 2, 3, 4, 5, 6	2, 3, 4, 5, 6	Caulking and Sealants, Expansion Joints
Elevated Temperature	1, 2	N/A	N/A
Irradiation	1, 2	N/A	N/A
Fatigue	1, 2, 3, 4	N/A	N/A
System Type Components			
General corrosion/oxidation	1	1	Non-EQ Electrical/Mechanical Penetrations, Personnel Airlocks, Equipment Hatch
Pitting/Crevice Corrosion	1	N/A	N/A
IASCC	1	N/A	N/A
SCC/IGSCC/IGA	1	N/A	N/A
Microbiologically Influenced Corrosion	1	N/A	N/A
Thermal Aging	1	N/A	N/A
Stress Relaxation	1	N/A	N/A

1 Containment Structure **3 Intake Structure** **5 FOST #21 Enclosure**
2 Auxiliary Building **4 Turbine Building** **6 CST #12 Enclosure**

The following paragraphs provide the demonstration for each group of components subject to an AMR that the effects of the plausible ARDMs identified in Table 7.1-3 will be adequately managed such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

Ground Floor/Slabs, Basemats, Foundations, and Walls (below grade portions only)

Table 7.1-3 lists aggressive chemical attack on concrete and corrosion of embedded steel/rebar as plausible ARDMs for the ground/floor slabs, basemats, foundations, and walls.

The below-grade portion of the ground floors/slabs, basemats, foundations, and walls are exposed to groundwater. Degradation of the concrete and of the associated rebar and embeds is only plausible if ground water chemical composition is significantly more aggressive than it was found to be during pre-construction testing. During initial plant construction, groundwater pH was tested and determined to be basic. In addition, conditions that are conducive to changes in pH are not present at CCNPP. Groundwater observation wells installed during initial plant construction will be used for the investigation of the ground water chemistry. Ground water chemistry samples will be taken and compared to pre-construction composition to verify that significant changes have not occurred.

Thus, if no significant changes have occurred causing aging, this will demonstrate that these aging mechanisms do not need further aging management. The below-grade portion of the ground floor/slabs, basemats, foundations, and walls will continue to be capable of performing their passive intended functions under all design conditions required by the CLB.

Intake Structure Fluid Retaining Walls and Slabs

Table 7.1-3 lists aggressive chemical attack on concrete and corrosion of embedded steel/rebar as plausible ARDMs for the fluid retaining walls and slabs of the Intake Structure.

The fluid retaining walls and slabs of the Intake Structure are in contact with the Chesapeake Bay water which has a significant chloride concentration. The chloride concentration could result in aggressive chemical attack on the Intake Structure fluid retaining walls and slabs and corrosion of the associated rebar and embeds. For this reason these two ARDMs are considered plausible. Corrosion of the associated rebar and embeds can only occur if aggressive chemical attack of the concrete is occurring first. Aggressive chemical attack will cause surface deterioration of the fluid retaining walls and slabs. The fluid retaining walls and slabs are accessible and inspected during outages. That inspection assesses and records the condition of the concrete and serves as the means for discovery of any degradation that may be caused by aggressive chemical attack. This inspection also serves as an indicator of degradation to the rebar and embeds.

Thus, the discussion above demonstrates that the plausible aging mechanisms discussed above will be managed such that the fluid retaining walls and slabs will continue to be capable of performing their passive intended functions under all design conditions required by the CLB.

Structural Steel Components

Table 7.1-3 lists corrosion of steel as a plausible ARDM for structural steel components. The structural steel components included in this group are indicated with an asterisk in Table 7.1-1.

All surfaces of steel components of Seismic Category I structures are covered by protective coatings, and corrosion of steel components cannot occur without a deterioration of their protective coatings. Moisture that penetrates degraded protective coatings can cause corrosion of the underlying carbon steel. Therefore, corrosion is considered a plausible ARDM. To provide assurance that the effects of corrosion will not prevent the performance of the intended functions of the steel components, the condition of protective coatings will be monitored.

Steel components of Seismic Category I structures are located in both accessible and nonaccessible areas. The aging management programs differ based on the location. Discovery of any degradation of the protective coating in accessible areas is accomplished by a number of activities, including periodic documented inspections by assigned systems engineers. Evaluation of degraded conditions, corrective action, and follow-up activities are controlled by existing plant programs for maintaining protective coatings. By maintaining the coatings of the external surfaces of the structural steel, corrosion of structural steel will be prevented.

The aging of structural steel located in inaccessible areas is not expected to be different from that of structural steel in accessible areas. To provide additional assurance that deterioration of structural steel protective coatings are not progressing differently, nonaccessible (those not routinely approachable during normal walkdowns) structural steel locations will be subject to an age-related degradation inspection in accordance with the IPA methodology described in Section 2.0.

Thus, the discussion of aging management activities presented above demonstrates that corrosion of structural steel will be managed such that the structural steel components will continue to be capable of performing their passive intended functions under all design conditions required by the CLB.

Liners

Table 7.1-3 lists corrosion of liners as a plausible ARDM. The refueling and spent fuel pool liners provide the fluid retention part of the pressure boundary function with the structural support part of the pressure boundary function provided by the surrounding concrete.

Liners are divided into two groups for discussion based on their material of construction: Carbon Steel and Stainless Steel. Stainless steel liners include the refueling pool liner and the spent fuel pool liner. The choice of material for these liners is based on limiting the effects of corrosion. However, corrosion is considered plausible in the heat-affected zones of welds in stainless steel.

Refueling Pool Liner - Corrosion is considered plausible in the heat-affected zone of welds in stainless steel liners. The refueling pool receives intermittent use and is normally maintained in a dry lay-up condition. Any corrosion in the heat-affected zones of welds would be indicated by leakage fro the pool. Historically, leakage from the refueling pool liner has been minimal and not attributed to corrosion in the heat-affected zones of welds. Monitoring of refueling pool leakage provides for the discovery of any degradation caused by corrosion.

Thus, the discussion above demonstrates that current leakage monitoring procedures will manage aging such that the refueling pool liner will continue to be capable of performing its fluid retention part of the pressure boundary function under all loading conditions required by the CLB.

Spent Fuel Pool Liner - Corrosion is considered plausible in the heat-affected zones of welds in stainless steel liners. The spent fuel pool receives continuous use. Any corrosion in the heat-affected zones of welds would be indicated by leakage from the pool. The spent fuel pool liner is fabricated from stainless steel plate, welded together at channel leak chases. These leak chases flow to "telltale valves." Current plant procedures address leakage testing for the Spent Fuel Pool by periodically monitoring water collected from these valves. Historically, no more than several hundred cubic centimeters of water have been collected during these tests, and the water collected has been found not to be borated, indicating that its source is not the spent fuel pool. Thus, leakage from the spent fuel pool liner has been minimal and not attributed to corrosion in the heat-affected zones of welds. Monitoring of refueling pool leakage provides for the discovery of any degradation caused by corrosion.

Thus, the discussion above demonstrates that current leakage monitoring procedures will manage aging such that the spent fuel pool liner will continue to be capable of performing its fluid retention part of the pressure boundary function under all loading conditions required by the CLB.

Carbon steel liners include the containment and containment basemat liners and corrosion is considered plausible for carbon steel liners.

Containment Liner - The interior surface of the containment liner is covered by a protective coating and corrosion of the containment liner cannot occur without a deterioration of the protective coating. Moisture that penetrates degraded protective coatings can cause corrosion of the underlying carbon steel. Therefore, corrosion is considered a plausible ARDM. To provide assurance that the effects of corrosion will not prevent the performance of the intended functions of the steel components, the condition of protective coatings is monitored.

The containment liner is located in both accessible and nonaccessible areas. The aging management programs differ based on the location. Discovery of any degradation of the protective coating in accessible areas is accomplished by a number of activities, including periodic documented inspections by assigned systems engineers.

The aging of the containment liner located in inaccessible areas is not expected to be different from that of the containment liner in accessible areas. To provide additional assurance that deterioration of the containment liner protective coatings are not progressing differently, nonaccessible (those not routinely approachable during normal walkdowns) containment liner locations will be subject to an age-related degradation inspection in accordance with the IPA methodology described in Section 2.0.

Thus, the discussion presented above demonstrates that corrosion of the containment liner will be managed such that the containment liner will continue to be capable of performing its passive intended functions under all design conditions required by the CLB.

Containment Basemat Liner - Corrosion of the exterior of the basemat liner is only plausible if degradation of the basemat concrete is occurring. The below-grade portion of the basemat liner could be exposed to groundwater, if it penetrates the basemat concrete. Degradation of the liner would only be plausible if ground water chemical composition is significantly more aggressive than it was found to be during pre-construction testing. During initial plant construction, groundwater pH was tested and determined to be basic. Conditions that are conducive to changes in pH are not present at CCNPP. Groundwater observation wells installed during initial plant construction will be used for the investigation of the ground water chemistry. Ground water chemistry samples will be taken and compared to pre-construction composition to verify that significant changes have not occurred.

Thus, if no significant changes have occurred causing aging, this will demonstrate that corrosion of the basemat liner does not need further aging management. The basemat liner will continue to be capable of performing its passive intended functions under all design conditions required by the CLB.

Post-Tensioning System

Table 7.1-3 lists prestress losses and corrosion of tendons as plausible ARDMs for the post-tensioning system.

Existing plant programs address checking containment tendon lift-off force. The associated frequency interval was developed during the containment design and was based on nuclear industry experience, considering the corrosion resistant properties of the tendon material and the environment to which this material is subjected. Plant procedures provide acceptance criteria for the prestress level and tendon system component physical conditions over the 40-year operating life. Prestress losses are time-dependent and are reflected in the curves of expected lift-off force versus time. However, these curves are currently only established for 40 years and will be re-evaluated to establish the predicted prestress levels during the license renewal period. This has been identified as a time-limited aging analysis (TLAA) during the TLAA process described in Section 2.0 with the resolution of recalculating predicted lift-off forces for the 40 to 60 year period.

Procedures also mandate the use of inspections of the tendons to detect indications of tendon corrosion and the use of laboratory testing to ensure that the sheathing filler is sufficient to maintain its function. The minimum prestress levels and the physical condition requirements currently established will not change. Inspections performed in accordance with existing plant procedures will be adequate to detect and correct loss of prestress and corrosion in containment tendons.

Thus, the discussion above demonstrates that the existing plant procedures in conjunction with re-evaluated lift-off forces versus time curves manage aging such that the containment post-tensioning system will continue to be capable of performing its intended functions under all design conditions required by the CLB.

Caulking and Sealants, Expansion Joints

Table 7.1-3 lists weathering as a plausible ARDM for the caulking and sealants and expansion joints.

Caulking/sealants and expansion joints located throughout CCNPP Seismic Category I structures are subject to plant specific conditions in which degradation due to the effects of weathering is plausible. The plant's recent identification of degraded caulking/sealants and expansion joint locations has confirmed that these components require aging management. A current inspection and maintenance program will be expanded to ensure that these components are identified and repaired or replaced as necessary. The inspection program will concentrate on caulking/sealants and expansion joints in exterior surfaces and in interior surfaces which mitigate high energy line break, flooding, and fire.

Thus, the discussion of aging management activities presented above demonstrates that the affects of aging due to weathering will be managed such that all caulking/sealants and expansion joints will continue to be capable of performing their passive intended functions under all design conditions required by the CLB.

Containment Penetrations, Airlocks, Equipment Hatch

Table 7.1-3 lists General Corrosion/Oxidation as a plausible ARDM for the containment penetrations, airlocks, and equipment hatch.

All surfaces are covered by protective coatings, and general corrosion/oxidation of steel components cannot occur without a deterioration of their protective coatings. Moisture that penetrates degraded protective coatings can cause general corrosion/oxidation of the underlying carbon steel. Therefore, general corrosion/oxidation is considered a plausible ARDM. To provide assurance that the effects of general corrosion/oxidation will not prevent the performance of the intended functions of these components, the condition of protective coatings will be monitored. Discovery of any degradation of the protective coating is accomplished by a number of activities, including periodic documented inspections by assigned systems engineers. Evaluation of degraded conditions, corrective action, and follow-up activities are controlled by existing plant programs for maintaining protective coatings. By maintaining the coatings of the external surfaces of the containment penetrations, airlocks, and equipment hatch, general corrosion/oxidation will be minimized or prevented.

Thus, the discussion of aging management activities presented above demonstrates that general corrosion/oxidation of structural steel will be managed such that the containment penetrations, airlocks, and equipment hatch will continue to be capable of performing their passive intended functions under all design conditions required by the CLB.

TABLE 7.1-4

LIST OF REFERENCES FOR SEISMIC CATEGORY I STRUCTURES

1. ACI 201.2R-67, "Guide to Durable Concrete," American Concrete Institute, 1967

2. ACI-209R-82, "Prediction of Creep, Shrinkage, and Temperature Effects in Concrete Structures," American Concrete Institute, 1982

3. ACI 215R-74, "Consideration for Design of Concrete Structures Subjected to Fatigue Loading," American Concrete Institute, 1986

4. ACI 318-63, "Building Code Requirements for Reinforced Concrete," American Concrete Institute, 1963

5. ACI 349-85, "Code Requirements for Nuclear Safety Related Concrete Structures," American Concrete Institute, 1985

6. ANSI/ANS-6.4, "Guidelines on the Nuclear Analysis and Design of Concrete Radiation Shielding for Nuclear Power Plants," American Nuclear Standard, 1985

7. ASME Section III, Division 2, "Code for Concrete Reactor Vessels and Containments, " American Society of Mechanical Engineers Boiler and Pressure Vessel Code, 1986

8. ASTM C-33-82, "Standard Specification for Concrete Aggregates," American Society of Testing and Materials, 1982

9 STM C-295-65, "Petrographic Examination of Aggregates for Concrete," American Society of Testing and Materials, 1965

10. ASTM C-289-66, "Potential Reactivity of Aggregates (Chemical Method), " American Society of Testing and Materials, 1966

11. "Aging Management Review Report for the Containment System (059)," Revision 0, July 28, 1995

12. "Component and Program Evaluation of Four Structures - Intake Structure, Turbine Building, FOST Enclosure, CST Enclosure - Calvert Cliffs Nuclear Power Plant," Revision 0, March 29, 1995

13. "Component Evaluation and Program Fvaluation Results for the Containment System," Revision 1, February 22, 1994

14. "Component Evaluation and Program Evaluation Results for the Auxiliary Building ," Revision 0, July 28, 1995

TABLE 7.1-4 (Continued)

LIST OF REFERENCES FOR SEISMIC CATEGORY I STRUCTURES

15. DG-1009 "Draft Regulatory Guide DG-1009, Standard Format and Content of Technical Information for Applications to Renew Nuclear Power Plants, Appendix A, December 1990

16. EPRI RP-2643-27, "Class I Structures License Renewal Industry Report," December 1991

17. EPRI NP 2643-5, "Components Life Estimation: LWR Structural Materials Degradation Mechanisms," September 1987

18. "Examination of the Unit 1 Containment Structure - Calvert Cliffs Nuclear Power Plant," August 1992

19. "Examination of Condensate Storage Tank #12 Enclosure - Calvert Cliffs Nuclear Power Plant," September 21, 1994

20. "Examination of Fuel Oil Storage Tank #21 Enclosure - Calvert Cliffs Nuclear Power Plant," September 21, 1994

21. "Examination of Intake Structure - Calvert Cliffs Nuclear Power Plant," October 24, 1994

22. "Examination of Auxiliary Feedwater Pump Rooms - Calvert Cliffs Nuclear Power Plant," October 27, 1994

23. IAEA-TECDOC-670, "Pilot Studies on Management of Aging of Nuclear Power Plant Components," International Atomic Energy Agency, October 1992

24. NUMARC 90-01, "Pressurized Water Reactor Containment Structures License Renewal Industry Report," Revision 1, September 1991

25. NUMARC 90-05, "Pressurized Water Reactor, Reactor Pressure Vessel Internals License Renewal Industry Report, " Revision 1, December 1992

26. NUREG-0797, "Safety Evaluation Report Related to the Operation of Comanche Peak Steam Electric Station, Units 1 and 2," July 1981

27. NUREG/CR-4652, ORNL/TM-10059, "Concrete Component Aging and its Significance Relative to Life Extension of Nuclear Power Plants," Oak Ridge National Laboratory, Oak Ridge, TN, September 1986

Component supports were scoped and the component supports requiring an aging management review (AMR) were identified in accordance with the process described in Section 2.0.

In accordance with 10 CFR 54.21, the scope of this report is limited to passive, long-lived component supports (such as pipe hangers and associated anchor bolts). For the purposes of this discussion, "component support" is defined as the connection between a system, or component within a system, and a plant structural member (e.g., the concrete floor or wall, structural beam or column, or ground outside the plant buildings). Supports for both the distributive portions of systems, such as piping and cable raceways, and system equipment items are included in the scope of this report. Systems having component supports addressed in this section are identified in Table 7.6-1.

A commodity approach was determined to be an appropriate approach for an AMR of the various system component supports based on the following:

- Although the systems within the scope of license renewal are diverse in function and physical appearance, the component supports within them are more standard. For example, spring hangers in the service water system and the main steam system serve the same function in each system and are physically similar.

- Component supports in diverse systems but subject to the same environment and loading conditions will degrade in a similar fashion.

The total population of component supports are grouped into categories based upon their application in the plant and then into component support types. Component support types are based on similarities of design, loading condition, and environment. As a result of the process described in Section 2.0, 20 component support types were determined to require an AMR. A list of these components support types is given in Table 7.6-2.

Intended Functions

Component supports subject to an AMR have the following passive intended functions:

a. Provide structural support for safety-related systems and components.

b. Provide structural and/or functional support, or both, for non-safety-related equipment where failure of this structural component could directly prevent satisfactory accomplishment of safety-related functions.

c. Provide structural support for non-safety-related systems and components which are required for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout, and credited in the analysis for these events included in the current licensing basis (CLB).

TABLE 7.6-1

SYSTEMS WITHIN THE SCOPE OF LICENSE RENEWAL CONTAINING SUPPORTS WITHIN THE COMMODITY EVALUATION

Electrical 125 Volt DC Distribution	Auxiliary Building and Radwaste Heating and Ventilation System
Electrical 4 kV Transformers and Busses	Auxiliary Feedwater
Electrical 480 Volt Transformers and Busses	Demineralized Water and Condensate Storage
Electrical 480 Volt Motor Control Centers	Sampling System (Nuclear Steam Supply System [NSSS])
Well and Pretreated Water	Technical Support Center Computer
Service Water Cooling	Reactor Protection
Saltwater Cooling	Primary Containment HVAC
Fire Protection	Containment Spray
Component Cooling Water	Control Boards
Instrument AC	Reactor Coolant
Vital Instrument AC	Spent Fuel Pool Cooling
Compressed Air	Waste Gas
Data Acquisition Computer	Hydrogen Recombiner
Diesel Fuel Oil	Area and Process Radiation Monitoring
Emergency Diesel Generators	Nuclear Instrumentation
Annunciation	Main Steam
Plant Heating	Lighting and Power Receptacles
Control Room Heating, Ventilation and Air Conditioning (HVAC)	

TABLE 7.6-2

SUPPORT COMMODITY COMPONENT TYPES REQUIRING AN AMR

Piping Supports
- Spring Hangers, Constant Load Supports, Sway Struts, Rod Hangers, and Snubber Supports[1] Outside Containment
- Spring Hangers, Constant Load Supports, Sway Struts, Rod Hangers, and Snubber Supports[1] Inside Containment
- Piping Frames Outside Containment
- Piping Frames Inside Containment

Cable Raceway Supports
- Channel, Clamp, and Other Supporting Styles Outside Containment
- Channel, Clamp, and Other Supporting Styles Inside Containment

HVAC Ducting Supports
- Rod Hanger Trapeze Supports Outside Containment
- Rod Hanger Trapeze Supports Inside Containment

Equipment Supports
- Anchorage Including Elastomer Vibration Isolators
- Electrical Cabinet Anchorage Outside Containment
- Electrical Cabinet Anchorage Inside Containment
- Electrical Equipment (load bearing insulation material)
- Equipment Frames (Instruments/Batteries on Racks) Outside Containment
- Equipment Frames (Instruments on Racks) Inside Containment
- Frames and Saddles (Tanks and Heat Exchangers) Outside Containment
- Frames and Saddles (Tanks and Heat Exchangers) Inside Containment
- Metal Spring Isolators and Fixed Bases Outside Containment
- Metal Spring Isolators and Fixed Bases Inside Containment
- Loss-of-Coolant Accident (LOCA) Restraints
- Ring Foundations for Flat-Bottom Vertical Tanks

Management of Component Aging

The potential age-related degradation mechanisms (ARDMs) for component supports are identified in Table 7.6-3. Those ARDMs which were not evaluated for a group of supports because they are not applicable to the group are noted by shading the corresponding blocks in this table. Those that were evaluated but were determined to be not plausible for any group of supports in this commodity evaluation are listed in a note to the table. Those ARDMs which were evaluated but determined to be not plausible for a particular group of supports have an "N/A" in the table for the unaffected group of

1 Snubber supports include the hardware from the wall and piping/equipment to the snubber pin connections. The snubber itself is not subject to AMR.

supports. Those ARDMs identified as plausible for a group of supports are noted by a check mark (✓) in the appropriate columns in Table 7.6-3.

Where ARDMs were determined to be plausible, an aging management strategy was selected which involves two separate but complementary sets of activities. The first set of activities consists of baseline walkdowns or inspections which are conducted one time to determine whether the plausible ARDMs are actually occurring for the supports potentially affected. The second set of activities involves follow-on actions which occur repetitively during the period of extended operation. The nature of the follow-on actions is dictated by the results of the baseline inspection or walkdowns. For example, if no evidence is found that the plausible ARDM is occurring during the baseline inspection, the follow-on actions credited may consist of periodic documented walkdowns by system engineers to ensure that this condition continues. If evidence of aging is found for certain groups during the baseline activities, follow-on actions may consist of more aggressive aging management activities. Baseline and follow-up activities are discussed in more detail below.

Baseline Activities

Two existing programs are primarily credited as baseline inspection activities for component supports. They are the Seismic Verification Project (SVP) and the Inservice Inspection (ISI) Program. The inspections conducted under these programs were performed for reasons other than license renewal. However, the discussion below for each of these programs will demonstrate that the inspections adequately assess whether aging effects are present for the component support type inspected.

To serve as an adequate baseline activity, the entire population of supports in a given group did not have to be subjected to the baseline inspection. If those supports in the groups which were not inspected are similar in design, material and environment to those which were inspected, the conclusion could be reached that an adequate baseline was conducted. If loading conditions, environmental conditions or equipment design differed significantly from the supports which were included in the baseline activity, focused baseline inspections for aging will be conducted to adequately baseline the condition of such supports.

TABLE 7.6-3

POTENTIAL AND PLAUSIBLE ARDMs FOR EQUIPMENT SUPPORTS

Potential ARDMs	Component Types for Which ARDM is Plausible							
	Piping Supports				Cable Raceway Supports		HVAC Ducting Supports	
	Spring Hangers, Constant Load Supports, Sway Struts, Rod Hangers, and Snubber Supports Outside Containment	Spring Hangers, Constant Load Supports, Sway Struts, Rod Hangers, and Snubber Supports Inside Containment	Piping Frames Outside Containment	Piping Frames Inside Containment	Channel, Clamp, and Other Supporting Styles Outside Containment	Channel, Clamp, and Other Supporting Styles Inside Containment	Rod Hanger, Trapeze Supports Outside Containment	Rod Hanger, Trapeze Supports Inside Containment
General. Corrosion of Steel	✓	✓	✓	✓	✓	✓	✓	✓
SCC of High-Strength Bolts	N/A	✓	N/A	✓	N/A	✓	N/A	✓
Elastomer Hardening								
Loading Due to Rotating/ Reciprocating Machinery								
Loading Due to Hydraulic Vibration or Water Hammer	✓	✓	N/A	N/A				
Loading Due to Thermal Expansion of Piping/ Component	✓	✓	N/A	N/A				
Other Loading (Abuse, Impacts, Accidents)	✓	N/A	✓	N/A	✓	N/A	✓	N/A

Note: Not plausible for entire commodity group:
- radiation embrittlement of steel
- grout/concrete local deterioration
- thermal effects on steel
- lead anchor creep

TABLE 7.6-3 (continued)

POTENTIAL AND PLAUSIBLE ARDMs FOR EQUIPMENT SUPPORTS

Potential ARDMs	Equipment Support Types for Which ARDM is Plausible											
	Anchorage Including Elastomer Vibration Isolators	Electrical Cabinet Anchorage Outside Containment	Electrical Cabinet Anchorage Inside Containment	Electrical Equip. (load bearing insulation material)	Equipment Frames (Instruments & batteries on racks) Outside Containment	Equipment Frames (Instruments on racks) Inside Containment	Frames and Saddles (Tanks & Heat Exchangers Outside Containment	Frames and Saddles (Tanks & Heat Exchangers Inside Containment	Metal Spring Isolators & Fixed Bases Outside Containment	Metal Spring Isolators & Fixed Bases Inside Containment	LOCA Restraints	Ring Foundation for Flat-bottom Vertical Tanks
General Corrosion of Steel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SCC of High-Strength Bolts	N/A	N/A	✓	N/A	N/A	✓	N/A	✓	N/A	✓	✓	N/A
Elastomer Hardening	✓			✓								
Loading Due to Rotating/ Reciprocating Machinery	N/A								✓	✓	✓	
Loading Due to Hydraulic Vibration or Water Hammer							✓	✓			✓	
Loading Due to Thermal Expansion of Piping/ Component							✓	✓			N/A	✓
Other Loading (Abuse, Impacts, Accidents)	✓	✓	N/A	✓	✓	N/A	✓	N/A	✓	N/A	N/A	✓

Note: Not plausible for entire commodity group:
- radiation embrittlement of steel
- grout/concrete local deterioration
- thermal effects on steel
- lead anchor creep

Seismic Verification Project

The SVP was established at Calvert C iffs Nuclear Power Plant (CCNPP) to resolve Unresolved Safety Issue A-46 related to the seismic adequacy of older nuclear power plants. The SVP used the NRC-approved Generic Implementation Procedure to verify the seismic adequacy of mechanical and electrical equipment required for safe shutdown following a seismic event. The seismic adequacy of electrical cable raceways (trays and conduit) was also evaluated using the Generic Implementation Procedure. Even though the project was established for other purposes, it is credited as a baseline inspection for many component support types for license renewal.

The SVP used the Seismic Qualification Utility Group methodology, whose acceptance criteria are based on the as-found condition of equipment and raceways in over 80 industrial facilities that have experienced strong-motion earthquakes. The average age of these facilities at the time of their assessment was 22 years, with 11 of these facilities being over 40 years old at the time of their assessment. Many equipment items and raceways in this database had already been subject to significant aging and still survived large seismic loadings with no significant damage. The Generic Implementation Procedure acceptance criteria are specifically based on the features or conditions of damaged equipment or raceways in the database that caused them to be more structurally vulnerable than similar equipment that was not damaged. Any equipment support found that does not meet the Generic Implementation Procedure criteria (and therefore may not be able to perform its intended function under all design conditions) is documented as an "outlier" and is evaluated further to determine what, if any, corrective action or modification is needed to resolve the concern.

Inspections performed by the SVP examine the component supports for indications of the following potential ARDMs:

- Grout/Concrete local deterioration.
- Steel load path and concrete load path degradation potentially caused by loadings from rotating/reciprocating machinery, hydraulic vibration or water hammer, and thermal expansion of piping/components.
- General corrosion of steel.
- Elastomer hardening.
- Abuse, impacts, and accidents.

- Stress Corrosion Cracking[2] .

Many of the component support types covered by this commodity evaluation were inspected by the SVP. Because the SVP inspections would discover any plausible aging effects for these supports and because these inspections were performed after approximately 20 years of plant operation, there is reasonable assurance that the ARDMs noted above are not as likely to occur if they were not discovered during the SVP inspections. Therefore, this program is credited as the baseline activity for a number of component support types. If no aging effects were discovered during these SVP inspections, a common set of follow-on activities is credited for the component support types covered by this baseline activity. This common set is described under Follow-on Activities in a subsequent paragraph of this License Renewal Application (LRA) Section.

Inservice Inspection Program

Existing CCNPP procedures require that ISI of ASME Code Class 1, 2, and 3 components be performed in accordance with ASME Section XI. Augmented inspections of portions of main steam and feedwater piping are also required. The CCNPP ISI Program Plan describes the inspections performed to satisfy these requirements. Even though the ISI was established for other purposes, it is credited as a baseline inspection for many component support types for license renewal.

The ISI Program at CCNPP for the current inspection interval was developed in accordance with ASME Section XI, "Rules for In-Service Inspection of Nuclear Power Plant Components." Specifically, Subsection IWF of Section XI[3] describes the examination requirements for component supports for Class 1, 2, and 3 piping systems.

The examination requirements of Section XI, Subsection IWF, apply to plate and shell type supports (supports fabricated from plate and shell elements such as skirts and saddles, normally subjected to biaxial stresses), linear type supports (supports acting under essentially a single component of stress, such as tension and compression struts, beams and columns, trusses, frames, arches, rings, and cables), and component standard supports (support assemblies consisting of one or more generally mass produced units usually referred to as "catalog items"). Requirements are provided for the examination of the following parts associated with these supports:

- mechanical connections to pressure retaining components and building structure;

- welded connections to building structure;

2 The Seismic Verification Project does not visually check for stress corrosion cracking. However, this aging mechanism is only plausible for equipment supports if high strength anchor bolting was installed in these supports at CCNPP. The SVP inspections did not discover any high strength concrete expansion anchors for any equipment at CCNPP providing additional assurance that SCC is not a concern for license renewal.

3 Currently the ISI Program at CCNPP is based in the 1983 edition of ASME Section XI with Addenda through Summer 1983.

- welded and mechanical connections at intermediate joints in multiconnected integral and non-integral supports; and

- component displacement settings of guides and stops, misalignment of supports, assembly of support items.

Section XI requirements address the frequency, examination methods, and acceptance standards associated with examinations of component supports and provide for additional examinations in cases where corrective measures are required. Visual examination procedures require that component supports be inspected for the effects of the following ARDMs:

- general corrosion of steel;

- stress corrosion cracking of bolts; and

- degradation due to vibration or thermal expansion cycles (loosening of bolted or pinned connections, loss of weld integrity, component displacement or realignment, and hanger setting drift).

The support types referred to in the Section XI, Subsection IWF requirements for ISIs correspond to several component support types addressed in this commodity evaluation. Specifically, all of the piping support types and two equipment support types (frames and saddles for tanks and heat exchangers and LOCA restraints) are included in the ISI requirements. Because the ISIs would discover any plausible aging effects for these supports, and because these inspections have been performed periodically during the initial 20 years of plant operation, there is reasonable assurance that the ARDMs noted above are not as likely to occur if they were not discovered during the ISIs. Therefore, this program is credited as the baseline activity for a number of component support types. Because ISI is an ongoing inspection requirement, it is also credited as the follow-on activity for component supports covered by this program. In some cases, the ISI Program is credited as the baseline activity for a component support type when certain supports in that support type are not covered by ISI. In these cases, the specific supports not covered by ISI are determined to be similar in design, loading condition, and environment to those covered under the ISI Program. If this is the case and if no aging effects were discovered during the baseline inspections, a common set of follow-on activities is credited for these component supports. This common set is described under Follow-on Activities in a subsequent paragraph of this LRA section.

The baseline activities discussed above determine the current condition of component support types within the scope of license renewal. Based on the extent to which aging effects are currently being experienced by the supports, the nature of follow-on aging management activities is determined. These follow-on activities are discussed below.

Follow-on Activities

Several different activities are credited as follow-on activities for ongoing aging management of component supports. If evidence of aging is found during the baseline inspections, follow-on activities include periodic focused inspections, equipment monitoring and other, more aggressive aging management practices. The specific follow-on activities will be discussed with the discussion of each component support type, later in this LRA section.

If no evidence of aging is found during the baseline inspection or no other special circumstances exist, the following activities will be credited for ongoing aging management:

- System engineer walkdowns provide reasonable assurance that if symptoms of the plausible ARDMs begin to occur, this condition will be reported and evaluated before the support's ability to perform its intended function would be impaired. System engineer walkdown guidelines contain specific guidance on component support condition concerns. The guidance also requires the system engineers to document the results of their walkdowns, and such walkdowns have already uncovered component support deficiencies similar to those that would occur due to aging (indicating that component support aging is being managed effectively).

- Continued ISI of the component supports covered by this program will serve as an ongoing aging management activity. The justification for crediting this program as a follow-on activity is identical to that for crediting the program for baseline inspections.

- Continued visual surveillance inspections of snubber supports will serve to supplement ISI inspections for this support type.

- Continued routine operations and housekeeping activities also support the conclusion that plausible aging mechanisms which have not occurred during the first 20 years of operation will continue to be inactive for the period of extended operation. Activities such as routine replacement of degraded paint and clean up of any pooled liquids will ensure that the environment affecting these component supports will not change substantially during the period of extended operation.

The following paragraphs provide the demonstration for each component support type subject to an AMR that the effects of the plausible aging mechanisms as identified in 7.6-3 are adequately managed such that there will be reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operations. The discussion is divided into four categories of supports: piping supports, cable raceway supports, HVAC ducting supports, and equipment supports.

Piping Supports

Piping Supports are subdivided into four component support types, and each is discussed below.

Spring Hangers, Constant Load Supports, Sway Struts, Rod Hangers, and Snubber Supports Outside Containment

As shown in Table 7-6.3, general corrosion, loading due to hydraulic vibration, loading due to thermal expansion (not applicable to snubber supports) and other loading (abuse impacts accidents) are the ARDMs considered to be plausible for these carbon steel piping supports.

Baseline Activities. In-service inspection activities adequately document the condition of piping supports for 10 of the 18 systems within the scope of license renewal and containing these types of supports. The eight systems not addressed by ISI are: Well and Pretreated Water, Fire Protection, Compressed Air, Diesel Fuel Oil, Plant Heating, Demineralized Water and Condensate Storage, NSSS Sampling System, and Condensate System. Due to the diversity in loading conditions affecting piping systems, additional sampling baseline walkdowns will be performed. These walkdowns will document the condition of the piping supports within the scope of license renewal and within this component support type for the eight systems listed above.

Follow-on Activities. In-service inspection will serve as the follow-on activity for those piping systems subject to that program. If degradation mechanisms are found during the additional baseline walkdown of the eight systems not covered by ISI, the type and frequency of subsequent follow-on walkdowns will be determined. If no aging effects are discovered during the additional baseline walkdowns, documented system engineer walkdowns will serve as the follow-on activity for those supports not covered by the ISI Program. For snubber supports, the snubber visual surveillance inspection, which is performed more frequently than ISI, will serve to supplement the ISI Program as a follow-on activity.

Spring Hangers, Constant Load Supports, Sway Struts, Rod Hangers, and Snubber Supports Inside Containment

As shown in Table 7.6-3, general corrosion, stress corrosion cracking of high-strength bolts, loading due to hydraulic vibration and loading due to thermal expansion (not applicable to snubber supports) are the ARDMs considered to be plausible for these carbon steel piping supports.

Baseline Activities. In-service inspection activities adequately document the condition of piping supports for 8 of the 11 systems utilizing these types of supports and located inside Containment. The three systems in containment with supports of this component support type which are not addressed by ISI are Fire Protection, Compressed Air, and NSSS Sampling. Due to the diversity in loading conditions affecting piping systems, additional sampling baseline walkdowns will be performed. These walkdowns will document the condition of the piping supports within the scope of license renewal and within this component support type for the three systems listed above.

Follow-on Activities. In-service inspection will serve as the follow-on activity for those piping systems subject to that program. If degradation mechanisms are found during the additional baseline walkdown of the three systems not covered by ISI, the type and frequency of subsequent follow-on activities will be determined. If no aging effects are discovered during the additional baseline walkdowns, documented system engineer walkdowns will serve as the follow-on activity for those supports not covered by the ISI Program. For snubber supports, the snubber visual surveillance inspection, which is performed more frequently than ISI, will serve to supplement the ISI Program as a follow-on activity.

Piping Frames Outside Containment

As shown in Table 7.6-3, general corrosion and other loading (abuse, impacts and accidents) are the ARDMs considered to be plausible for these carbon steel piping supports.

Baseline Activities. In-service inspection activities adequately document the condition of piping supports for 10 of the 18 systems within the scope of license renewal and containing these types of supports. The eight systems not addressed by ISI are: Well and Pretreated Water, Fire Protection, Compressed Air, Diesel Fuel Oil, Plant Heating, Demineralized Water and Condensate Storage, NSSS Sampling System, and Condensate System. Since the environment and materials for the piping stanchions and frames outside containment are similar to the environment and material of the spring hangers, constant load supports, rod hangers, and snubber supports outside containment, the results of the additional baseline walkdowns of the those supports are considered representative of the piping stanchions and frames. If during the sampling baseline walkdown of the supports for the eight additional piping systems, as described under "Spring Hangers, Constant Load Supports, Sway Struts, Rod Hangers, and Snubber Supports Outside Containment," significant aging effects are identified, then the inspection scope will be expanded to include piping stanchions and frames outside containment.

Follow-on Activities. In-service inspection will serve as the follow-on activity for those piping systems subject to that program. If degradation mechanisms are found during the additional baseline walkdowns, the type and frequency of subsequent follow-on activities will be determined. If no aging effects are discovered during the additional baseline walkdowns, documented system engineer walkdowns will serve as the follow-on activity for those supports not covered by the ISI Program.

Piping Frames Inside Containment

As shown in Table 7.6-3, general corrosion and stress corrosion cracking of high-strength bolts are the ARDMs considered to be plausible for these carbon steel piping supports.

Baseline Activities. In-service inspection activities adequately document the condition of piping supports for 8 of the 11 systems utilizing these types of supports and located inside Containment. The three systems in containment with supports of this component support type which are not addressed by ISI are Fire Protection, Compressed Air, and NSSS Sampling. Due to the diversity in loading conditions affecting piping systems, additional sampling baseline walkdowns will be performed. These walkdowns will document the condition of the piping supports within the scope of license renewal and within this component support type for the three systems listed above.

Follow-on Activities. In-service inspection will serve as the follow-on activity for those piping systems subject to that program. If degradation mechanisms are found during the additional baseline walkdowns of the three systems not covered by ISI, the type and frequency of subsequent follow-on activities will be determined. If no aging effects are discovered during the additional baseline walkdowns, documented system engineer walkdowns will serve as the follow-on activity for those supports not covered by the ISI Program.

The above discussion provides the demonstration that the baseline and follow-on activities described above will ensure that piping supports within the scope of license renewal will continue to be capable of performing their intended functions under all design conditions required by the CLB.

Cable Raceway Supports

Cable raceway supports are subdivided into two component support types, and each is discussed below.

Channel Clamp and Other Supporting Styles Outside Containment

As shown in Table 7-6.3, general corrosion and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel cable raceway supports.

Baseline Activities. All cable raceways within the scope of license renewal in the Auxiliary Building and Intake Structure and portions of the Turbine Building were visually inspected during the SVP, and no aging effects were identified. The raceway supports in the portions of the Turbine Building that were not visually inspected are constructed of the same materials and exposed to essentially the same environment as those in the Auxiliary Building. Thus, no additional baseline activities are required.

Follow-on Activities. Since no aging effects were identified during the baseline inspections of this group of supports, documented system engineer walkdowns will serve as the follow-on activity for this group.

Channel Clamp and Other Supporting Styles Inside Containment

As shown in Table 7-6.3, general corrosion and stress corrosion cracking of high-strength bolts are the ARDMs considered to be plausible for these carbon steel cable raceway supports.

Baseline Activities. All cable raceways in the Unit 1 and Unit 2 Containments within the scope of license renewal were visually inspected during the SVP, and no significant aging effects were identified. Thus, no additional baseline activities are required.

Follow-on Activities. Since no aging effects were identified during the baseline inspections of this group of supports, documented system engineer walkdowns will serve as the follow-on activity for this group.

The above discussion provides the demonstration that the baseline and follow-on activities described above will ensure that cable raceway supports within the scope of license renewal will continue to be capable of performing their intended functions under all design conditions required by the CLB.

HVAC Ducting Supports

Heating, ventilation and air conditioning ducting supports are subdivided into two component support types, and each is discussed below.

HVAC Rod Hanger, Trapeze Supports Outside Containment

As shown in Table 7.6-3, general corrosion and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel HVAC ducting supports.

Baseline Activities. Although the HVAC ducting supports are outside the scope of the SVP and ISI, ducting supports located outside of containment are constructed of the same materials and are located in the same plant areas as raceway supports that were visually inspected during the SVP. Since the materials of construction (i.e., carbon steel) and environment of the HVAC supports are similar to the raceway supports, and they are subjected to the same plausible mechanisms, no additional baseline activities are required.

Follow-on Activities. Since no aging effects were identified during the baseline inspections of the cable raceway supports (and these supports are similar to the HVAC supports), documented system engineer walkdowns will serve as the follow-on activity for this group.

HVAC Rod Hanger, Trapeze Supports Inside Containment

As shown in Table 7.6-3, general corrosion and stress corrosion cracking of high-strength bolts are the ARDMs considered to be plausible for these carbon steel HVAC ducting supports.

Baseline Activities. HVAC ducting supports are not included in either the ISI or SVP Programs. Ducting supports inside containment are not sufficiently similar in material or environment to raceway supports inside containment to allow the baseline inspection of the raceway supports to serve as the baseline for ducting supports in containment. Therefore, a sampling baseline walkdown of the condition of the ducting supports for the containment heating and ventilation system will be performed. This sampling baseline walkdown scope will include inspections for corrosion and will be documented by field notes and photographs, where possible.

Follow-on Activities. If aging effects are found during the baseline walkdown, the type and frequency of subsequent follow-on activities will be determined. If no aging effects are discovered during the baseline activities, documented system engineer walkdowns will serve as the follow-on activities for this group of supports.

The above discussion provides the demonstration that the baseline and follow-on activities described above will ensure that the HVAC ducting supports within the scope of license renewal will continue to be capable of performing their intended functions under all design conditions required by the CLB.

Equipment Supports

Equipment Supports are subdivided into twelve component support types, and each is discussed below.

Anchorage Including Elastomer Vibration Isolators

As shown in Table 7.6-3, general corrosion, elastomer hardening and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. Most of the equipment items within the scope of license renewal located outside containment with elastomer vibration isolators were included in the SVP. Those not within the SVP are similar in design, materials and environment and therefore the SVP is considered to be sufficient to provide the baseline activity for this group of supports.

Follow-on Activities. The SVP found no effects of aging for this group of supports with the exception of those for the control room HVAC air handler[4]. A modification is planned to replace the control room HVAC air handler elastomer isolators with spring-type isolators. For the other supports in this group, documented system engineer walkdowns will serve as the follow-on activity.

Electrical Cabinet Anchorage Outside Containment

As shown in Table 7.6-3, general corrosion and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. The majority of these anchors within the scope of license renewal were included in SVP. Those not included were similar in design, material and environment to those that were inspected under the SVP. Therefore, no additional baseline activities are required.

Follow-on Activities. Although corrosion is a plausible degradation mechanism for anchorages, the SVP walkdowns found no evidence of corrosion for anchorages outside containment, with the exception of the sampling hoods in the NSSS sampling system. Cabinet anchorages for two NSSS sampling hoods, included in the SVP, were identified as having significant corrosion[5]. Although these cabinets were judged to have adequate capacity for their design loads at the time of inspection, further focused inspections will be conducted for these hoods in order to monitor corrosion in the anchorages. The frequency of these inspections will be determined based on the

4 The environment of the Control Room HVAC Air Handlers was determined to be significantly more aggressive than the environment for the other supports of this group.

5 The environment for the NSSS Sampling cabinet anchorages was determined to be significantly more aggressive than the anchorages for the other cabinets in this group.

results of the inspections. For the remaining electrical cabinet anchorages, documented system engineer walkdowns will serve as the follow-on activity for this group.

Electrical Cabinet Anchorage Inside Containment

As shown in Table 7.6-3, general corrosion and stress corrosion cracking of high-strength bolts are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. Since the anchorages for electrical cabinets located within containment were not included in the SVP program and these anchorages could be subject to a more aggressive environment than those outside the containment covered by the SVP, baseline walkdowns of these anchorages will be performed. These walkdowns will include inspections for corrosion and will be documented in field notes and photographs, where possible.

Follow-on Activities. If no aging effects are discovered during the baseline inspections, documented system engineer walkdowns will serve as the follow-on activity for this group of supports. If aging effects are discovered, the type and frequency of further inspections will be determined based on the results of the baseline.

Electrical Supports Which Have Load Bearing Insulation Material

This component support type includes supports for transformers, battery chargers and inverters where there are electrical insulating materials in the component's load bearing path. As shown in Table 7.6-3, general corrosion, elastomer hardening and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. Most of these electrical equipment supports were included in the SVP. Those not included are similar in design, material and environment and therefore, no additional baseline activity is required.

Follow-on Activities. During the baseline inspections, no effects of aging from corrosion or other loading (abuse, impacts, accidents) were discovered. Documented system engineer walkdowns will serve as the follow-on activity for corrosion and other loading concerns. Elastomer hardening would not be detectable by visual inspection techniques for this component support type. However, this aging mechanism would only affect insulating material in the load bearing path. Insulating material in the load-bearing path contributes minimally to the structural support function and hardening of such material occurs gradually over time. In order for degradation of the insulating material to impact the structural support function, it would have had to progress far beyond the point where it would have caused failure of the active, intended function of the electrical equipment. Therefore, programs (independent of license renewal) which maintain operability of active electrical equipment will ensure that aging of such insulating material could not affect the structural support function, and no follow-on activities are necessary to manage the effects of this type of aging on the structural integrity function.

Equipment Frames for Instruments and Batteries on Racks Outside Containment

As shown in Table 7.6-3, general corrosion and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. Many systems within the scope of license renewal located outside containment with frame-type supports were included in the SVP. Those not specifically included are similar in design, material and environment to the supports included in the baseline and therefore, no additional baseline activities are required.

Follow-on Activities. In a walkdown of approximately 300 instruments on racks, the SVP program found no indication that aging effects are occurring. Therefore, documented system engineer walkdowns will serve as the follow-on activity for this group of supports.

Equipment Frames for Instruments on Racks Inside Containment

As shown in Table 7.6-3, general corrosion and stress corrosion cracking of high-strength bolts are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. A representative sample of this component support type located inside containment was included in the SVP. Due to the number and variety of supports of this type outside containment which were included in SVP, complemented by inspections of a representative sample inside containment, no additional baseline activities are necessary for this group of supports.

Follow-on Activities. Since no significant aging effects were identified during the baseline inspections of this group of supports, documented system engineer walkdowns will serve as the follow-on activity for this group of supports.

Stanchions, Frames and Saddles (Tanks and Heat Exchangers) Outside Containment

As shown in Table 7.6-3, general corrosion, loading due to hydraulic vibration, loading due to thermal expansion and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. Tanks and heat exchanger supports for most of the systems within the scope of license renewal outside of containment were included in the SVP or ISI. For those systems not specifically covered by SVP or ISI, the design, materials and environment are similar to supports covered by these baseline activities. Therefore, no further baseline inspections are considered to be necessary.

Follow-on Activities. The SVP walkdowns and ISI baseline inspections did not identify any effects of aging mechanisms. Therefore, follow-on activities for this group will consist of ISIs for those supports covered by the program and documented system engineer walkdowns for those supports not covered by the ISI Program.

Frames and Saddles (Tanks and Heat Exchangers) Inside Containment

As shown in Table 7.6-3, general corrosion, stress corrosion cracking of high-strength bolts, loading due to hydraulic vibration and loading due to thermal expansion are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. Tanks and heat exchanger supports for a representative sample of the systems inside of containment and within the scope of license renewal were included in the SVP. For those systems not specifically covered by SVP, the design materials and environment are similar to those covered by the SVP. Therefore, no additional baseline inspections are necessary for this group of supports.

Follow-on Activities. The baseline inspections of these supports found no effects of aging, therefore, documented system engineer walkdowns will serve as the follow-on activity for this group.

Metal Spring Isolators and Fixed Bases Outside Containment

As shown in Table 7.6-3, general corrosion, loading due to rotating/reciprocating machinery and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. Over half of the mechanical components with spring isolators or fixed bases for systems within the scope of license renewal and located outside of containment were included in the SVP. The supports not specifically included are similar in design, materials and environment to supports included in the SVP; therefore, no additional baseline activities are required.

Follow-on Activities. Visual inspections performed for the SVP did not identify any aging effects; however, it is possible that degradation from loading due to rotating/reciprocating machinery could occur without being observed by visual inspection techniques alone. As part of the CCNPP Vibration Monitoring Program, periodic vibration measurements are taken on rotating and reciprocating machinery. The measurements are trended and compared to baseline readings. Because degraded equipment supports result in increased vibrations levels, the Vibration Monitoring Program will serve to supplement documented system engineer walkdowns as the follow-on activities for this component support type.

Metal Spring Isolators and Fixed Bases Inside Containment

As shown in Table 7.6-3, general corrosion, stress corrosion cracking of high-strength bolts and loading due to rotating/reciprocating machinery are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. The containment cooler fan supports are the only component supports of this type. The containment cooler fan supports were included in the SVP. Therefore, no additional baseline activities are necessary.

Follow-on Activity. Since no aging effects were discovered during the baseline inspections, documented system engineer walkdowns will serve as the follow-on activity for this group of supports. If the Vibration Monitoring Program indicates degradation of other supports from loading due to rotating/reciprocating machinery, the need to expand the scope of this program to the containment cooler fans will be evaluated.

LOCA Restraints (e.g., pressurizer and reactor coolant pump supports)

As shown in Table 7.6-3, general corrosion, stress corrosion cracking of high-strength bolts, loading due to rotating/reciprocating machinery and loading due to hydraulic vibration are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. The only components whose supports are in this component support type are the reactor coolant pumps and pressurizer which are included in the ISI Class 1 Program. Therefore, no further baseline activities are required for this group of supports.

Follow-on Activities. Continued inspection as required by the ISI will serve as the follow-on activity for this group of supports. Additionally, the reactor coolant pumps are included in the CCNPP Vibration Monitoring Program, and this program will supplement the ISI Program inspection as described previously under the "Metal Spring Isolators and Fixed Bases Outside Containment" section.

Ring Foundations for Flat-Bottom Vertical Tanks

As shown in Table 7.6-3, general corrosion, loading due to thermal expansion and other loading (abuse, impacts, accidents) are the ARDMs considered to be plausible for these carbon steel equipment supports.

Baseline Activities. All flat-bottom vertical tank supports within the scope of license renewal on concrete ring foundations were included in the SVP and therefore no further baseline activities are required.

Follow-on Activities. Since no significant aging effects were discovered during the baseline inspections, system engineer walkdowns will serve as the follow-on activity for this group of supports.

The above discussion provides the demonstration that the baseline and follow-on activities described above will ensure that the equipment supports within the scope of license renewal will be capable of performing their intended functions under all design conditions required by the CLB.

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