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NRC FORM 658
(9-1999)

LL-6

U.S. NUCLEAR REGULATORY COMMISSION

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TRANSMITTAL OF MEETING HANDOUT MATERIALS FOR IMMEDIATE PLACEMENT IN THE PUBLIC DOMAIN

This form is to be filled out (typed or hand-printed) by the person who announced the meeting (i.e., the person who issued the meeting notice). The completed form, and the attached copy of meeting handout materials, will be sent to the Document Control Desk on the same day of the meeting; under no circumstances will this be done later than the working day after the meeting.
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DATE OF MEETING: 12/6/99

The attached document(s), which was/were handed out in this meeting, is/are to be placed in the public domain as soon as possible. The minutes of the meeting will be issued in the near future. Following are administrative details regarding this meeting:

Docket Number(s):

Plant/Facility Name:

TAC Number(s) (if available): MA 6859

Reference Meeting Notice: Public Workshop on Nuclear Power Plant License Renewal

Purpose of Meeting (copy from meeting notice): [copy of meeting notice attached]

NAME OF PERSON WHO ISSUED MEETING NOTICE: RAJ ANAND

TITLE: Project Manager

OFFICE: NRC / NRR / DRIP

DIVISION: DRIP

BRANCH: RLSB

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
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October 28, 1999

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MEMORANDUM TO: Christopher I. Grimes, Chief
License Renewal and Standardization Branch
Division of Regulatory Improvement Programs

FROM: Raj K. Anand, Project Manager R. Anand
License Renewal and Standardization Branch
Division of Regulatory Improvement Programs

SUBJECT: PUBLIC WORKSHOP ON NUCLEAR POWER PLANT LICENSE RENEWAL

DATE & TIME: December 6, 1999
8:00 a.m. - 5:00 p.m.

LOCATION: Auditorium of the U.S. Nuclear Regulatory Commission
Two White Flint North
11545 Rockville Pike
Rockville, Maryland 20855

PURPOSE: To gather feedback on which existing aging management programs need to be augmented for license renewal and which programs adequately manage aging effects without change. The draft agenda for the workshop is attached.

PARTICIPANTS:*

NRC	NEI & UCS
C. Grimes, NRR	D. Walters
P.T. Kuo, NRR	D. Lochbaum
R. Anand, NRR	et al.
et al.	

Attachment: Workshop Agenda

cc w/att: See next page

CONTACT: Raj K. Anand, NRR
301-415-1146

*Meetings between NRC technical staff and applicants or licensees are open for interested members of the public, intervenors, or other parties to attend as observers pursuant to "Commission Policy Statement on Staff Meetings Open to the Public" 59 Federal Register 48340, 9/20/94.

PUBLIC WORKSHOP ON NUCLEAR POWER PLANT LICENSE RENEWAL

Purpose: To gather feedback on which existing aging management programs need to be augmented for license renewal and which programs adequately manage aging effects without change

December 6, 1999
Rockville, Maryland

Office of Nuclear Reactor Regulation
Office of Nuclear Regulatory Research

SCHEDULE

10/99	Meeting with NEI to plan initial workshop
12/99	Workshop on GALL and SRP outline
3/00	NEI provide aging/program information input to GALL
6/00	NEI provide revised NEI 95-10
8/00	Issue draft GALL, SRP, and RG/NEI 95-10 for public comment
9/00	Public meeting and workshop to gather public comments
10/00	NEI revise NEI 95-10
11/00	Commission briefing on public comments on draft GALL, SRP, and RG/NEI 95-10
2/01	ACRS meeting on GALL, SRP, and RG/NEI 95-10
3/01	Commission approval of GALL and SRP
4/01	NEI comments on need for rulemaking
5/01	Public meeting to discuss need for rulemaking
7/01	Staff recommendation to Commission on rulemaking

LICENSE RENEWAL RULE (PART 54)

- Focus is aging management
- Functionality of active or short-lived structures and components is assured by existing regulatory process, existing licensee programs and activities, and maintenance rule
- License renewal rule requires aging management review of passive, long-lived structures and components

CREDIT FOR EXISTING PROGRAMS FOR LICENSE RENEWAL

Issue Statement

To what extent should the staff review existing programs relied on for license renewal, to conclude that an applicant has demonstrated reasonable assurance that such programs will be effective in managing the effects of aging on the functionality of structures and components in the period of extended operation?

Staff Paper, SECY 99-148, "Credit for Existing Programs for License Renewal"

Staff described options and provided recommendation to improve efficiency of license renewal process

CREDIT FOR EXISTING PROGRAMS FOR LICENSE RENEWAL (SECY 99-148)

<u>Staff Requirements Memorandum (August 27, 1999)</u>

- Focus review guidance in standard review plan (SRP) on areas where existing programs should be augmented
- Develop "Generic Aging Lessons Learned" (GALL) report, SRP, and regulatory guide (RG) with stakeholder participation
- Brief Commission on public comments
- Obtain Commission approval for publication
- Provide staff recommendation on rulemaking after additional review experience

GENERIC AGING LESSONS LEARNED (GALL)

Generic evaluation of existing programs to identify areas where existing programs should be augmented for license renewal

- **Build on previous GALL report (NUREG/CR-6490) which is a systematic compilation of plant aging information**
- **Review aging effects on components and structures, identify relevant existing programs, and evaluate program attributes to manage aging effects**
- **Review of Argonne National Laboratory and Brookhaven National Laboratory draft GALL report by staff**
- **Invite stakeholders to comment on GALL report and provide information on aging and programs**

BACKGROUND OF "GALL" REPORT

- NUREG/CR-6490 (Vols. 1 & 2; 12/96) is an extensive and systematic compilation of plant aging information
- Based on review of over 500 documents:
  - Nuclear Plant Aging Research (NPAR) program reports
  - NUMARC (now, NEI) industry reports on license renewal
  - Licensee events reports
  - Information Notices, Generic letters, and Bulletins

STANDARD REVIEW PLAN FOR LICENSE RENEWAL

Revise draft SRP to focus staff review on areas where existing programs should be augmented for license renewal

- **Reference GALL report for crediting existing programs**
- **Develop template to incorporate GALL information**
- **Develop guidance on acceptable augmented programs**
- **Incorporate lessons learned and resolution of license renewal issues**
- **Compatible with standard format of license renewal application**

REGULATORY GUIDE FOR LICENSE RENEWAL

- Draft regulatory guide (DG-1047) issued August 26, 1996, for public comment to endorse Nuclear Energy Institute (NEI) 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 — The License Renewal Rule"

- Plan for NEI to revise NEI 95-10 based on lessons learned, resolution of license renewal issues, standard format, and development of GALL report and SRP

- Staff review of revised NEI 95-10 for endorsement in regulatory guide

CONTENTS OF DRAFT "GALL" REPORT

I. Introduction
II. Containment Structure
III. Structures and Component Supports
IV. Reactor Vessel, Internals, and Reactor Coolant System
V. Engineered Safety Features
VI. Electrical Components
VII. Auxiliary Systems
VIII. Steam and Power Conversion System
IX. Summary and Conclusions
Appendix: Quality Assurance

DRAFT "GALL" TABLE COLUMN HEADINGS

- Item
- Structure and Component
- Region of Interest
- Material
- Environment
- Aging Effect
- Aging Mechanism
- References
- Existing Aging Management Program
- Evaluation and Technical Basis
- Further Evaluation

ATTRIBUTES OF AGING MANAGEMENT PROGRAMS

1. Scope of program
2. Preventive actions
3. Parameters monitored or inspected
4. Detection of aging effects
5. Monitoring and trending
6. Acceptance criteria
7. Corrective actions
8. Confirmation process
9. Administrative controls
10. Operating experience

EXAMPLES OF "REGULATED PROGRAMS"

"Regulated programs" are required by regulation (Part 50) or subject to other regulatory requirements (such as technical specifications)

<u>Examples</u>:

- **Environmental qualification of electrical equipment (§50.49)**
- **Maintenance rule (§50.65)**
- **Inservice inspection (§50.55a)**
- **Containment inservice inspection (§50.55a)**
- **Containment leak rate test (Appendix J, Part 50)**
- **Quality assurance (Appendix B, Part 50)**
- **Reactor vessel integrity (Appendices G and H, Part 50)**
- **Pressurized thermal shock (§50.61)**
- **Fire protection (§50.48)**
- **Steam generator tube inspection (technical specification)**

EXAMPLES OF "REACTIVE PROGRAMS"

"Reactive programs" are NRC requested actions to address operating issues (such as licensee response to bulletins and generic letters)

<u>Examples</u>:

- **Service water program (Generic Letter 89-13)**
- **Erosion/corrosion program (Bulletin 87-01, Generic Letter 89-08)**
- **Coating program (Generic Letter 98-04)**
- **Boric acid corrosion program (Generic Letter 88-05)**
- **Bolting program (Bulletin 82-02)**
- **Control rod drive mechanism nozzle and other closure head penetration nozzles (Generic Letter 97-01)**

EXAMPLES OF "GENERAL PRACTICE PROGRAMS"

"General practice programs" are routine maintenance, industry or equipment vendor recommended activities, and other trade programs

<u>Examples</u>:

- **Preventive maintenance**
- **Water chemistry control**
- **Crane inspection**

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Existing Aging Management Programs for License Renewal

David Lochbaum

Nuclear Safety Engineer

dlochbaum@ucsusa.org

December 6, 1999

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Introduction

① Current NRC staff position on aging management appears to be based on questionable assumptions:

no two plants are alike, but are assumed identical

credit for non-existent administrative measures

conformance with current licensing basis

② Current NRC staff approach to lessons learned appears to be one-directional:

reducing testing frequencies

missing extent-of-condition evaluations

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Questionable Assumption Snowflakes

Draft GALL Report, October 15, 1999:

"All components in the steam turbine system are classified as Group D Quality Standards." p. VIII A-3

Every plant in the US is different. Calvert Cliffs Unit 1 is different from Calvert Cliffs Unit 2. Like snowflakes, no two plants are alike. Also like snowflakes, plants can melt if they get too warm. Using over-simplifying assumptions, the NRC staff is ignoring key differences and failing in its temperature control job.

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Questionable Assumption Lottery Ticket Regulation

Draft GALL Report, November 12, 1999:

"While no requirement currently exists for such a program [electrical bus inspection program], periodic visual inspection of electrical buses is a potential method of managing aging degradation for these components." p. VI D-4

The NRC staff must not accept component aging based on things that could be done. Purchasing a lottery ticket is not the same as winning the lottery.

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Questionable Assumption Boilerplate[1]

10 CFR § 54.29, Standards for issuance of a renewed license, May 8, 1995:

"...there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB [current licensing basis]…".

[1] **Boilerplate may be good in ship hulls, but <u>not</u> in nuclear safety.**

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Questionable Assumption Remember TIME?

NRC letter dated October 9, 1996:

"Over the past several months, NRC's findings during inspections and reviews have identified broad programmatic weaknesses that have resulted in design and configuration deficiencies at some plants, which could impact the operability of required equipment...".

"Overall, the NRC staff has found that some licensees have failed to (1) appropriately maintain or adhere to plant design bases, (2) appropriately maintain or adhere to the plant licensing basis, (3) comply with the terms and conditions of licenses and NRC regulations..."

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Questionable Assumption TIME Again?

UCS Report, *The Good, The Bad, and The Ugly*, June 1998:

25 percent of the reported problems at Calvert Cliffs involved design error

Public Citizen Report, *Amnesty Irrational*, August 1999:

"From October 1996 through May 1999, 102 of 111 nuclear reactors have reported over 500 instances where they have been splitting atoms while 'outside design basis.'"

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Questionable Assumption Last TIME

The 1995 license renewal rule assumes that the current licensing basis is being met.

The approach to aging management assumes that all licensees will meet all requirements and effectively implement all administrative programs.

The 1996-1999 data refutes these assumptions in a very big way. If there's a lesson to be learned...

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One-Directional Approach Test for Success

Draft GALL Report, November 12, 1999:

"However, aging degradation does occur and has led to failures. ... Most of the [electric cable] failures are detected by operation of the component; relatively few are detected by maintenance or surveillance." p. VI A-6

Through Standard Tech Specs and individual license amendments, NRC allows licensees to extend the testing interval, thus performing fewer tests. Aging causes bad cables and bad cables can only be detected by operating the equipment. NRC should allow license renewal or reduced testing frequencies -- not both!

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One-Directional Approach
Less is More, But More What?

GALL et al looks at broad industry experience to reduce scope of license renewal effort.

It appears the NRC uses GALL et al to trim the scope of future license renewal application reviews. It is not apparent NRC reviews findings from the perspective of expanding the scope. Findings must trigger proper extent-of-condition evaluations.

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Recommendations

- "One size fits all" approach not used unless proven to be bounding
- No credit for programs which do not exist
- ★ Penalties should be very harsh for licensees failing to conform to the conditions of their licenses
- License renewal should not proceed in a vacuum
- Findings should trigger extent-of-condition evaluations

DRAFT

GENERIC AGING LESSONS LEARNED

(GALL) REPORT

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

Draft — December 6, 1999

CHAPTER I

INTRODUCTION

Background

By letter dated March 3, 1999, the Nuclear Energy Institute (NEI) documented the industry's views on how existing plant programs and activities should be credited for license renewal. The "credit" issue was: to what extent should the staff review existing programs relied on for license renewal, to conclude that an applicant has demonstrated reasonable assurance that such programs will be effective in managing effects of aging on the functionality of structures and components in the period of extended operation. In a staff paper, SECY-99-148, "Credit for Existing Programs for License Renewal," dated June 3, 1999, the staff described options and provided a recommendation for crediting existing programs to improve the efficiency of the license renewal process.

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The current effort reviews the aging effects on components and structures, identifies the relevant existing programs, and evaluates program attributes to manage aging effects for license renewal. This report is prepared with the technical assistance of the Argonne National Laboratory and the Brookhaven National Laboratory. As directed in the SRM, this report has the benefit of the experience from the staff members who conducted the review of the initial license renewal applications. Also, as directed in the SRM, the staff is seeking stakeholders' participation in the development of this report.

The results of the GALL effort are presented in a table format. The table column headings are: Item, Structure and Component, Region of Interest, Material, Environment, Aging Effects, Aging Mechanism, References, Existing Aging Management Program, Evaluation and Technical Basis, and Further Evaluation. Program attributes are evaluated for their adequacy

in managing certain aging effects for particular structures and components. The evaluation is based on the review of these 10 attributes: scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. If the evaluation determines that a program is adequate to manage certain aging effects for a particular structure and component without change, the "Further Evaluation" entry would indicate no further staff evaluation is recommended for license renewal. Otherwise, it would recommend area(s) where the staff should focus its review.

Application of GALL Report

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II. CONTAINMENT STRUCTURE

- A. PWR Containment
- B. BWR Containment

III. STRUCTURES AND COMPONENT SUPPORTS

- A. Class 1 Structures
- B. Component Supports

IV. REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

- A1. Reactor Vessel (BWR)
- A2. Reactor Vessel (PWR)
- B1. Reactor Vessel Internals (BWR)
- B2. Reactor Vessel Internals (PWR) - Westinghouse
- B3. Reactor Vessel Internals (PWR) - Combustion Engineering
- B4. Reactor Vessel Internals (PWR) - Babcock & Wilcox
- C1. Reactor Coolant Pressure Boundary (BWR)
- C2. Reactor Coolant System & Connected Lines (PWR)
- D1. Steam Generator (Recirculating)
- D2. Steam Generator (Once-Through)

V. ENGINEERED SAFETY FEATURES

- A. Containment Spray System (PWR)
- B. Standby Gas Treatment Systems (Secondary Containment) (BWR)
- C. Containment Isolation Components
- D1. Emergency Core Cooling System (PWR)
- D2. Emergency Core Cooling System (BWR)
- E. Fan Cooler System

VI. ELECTRICAL COMPONENTS

- A. Electric Cables
- B. Electrical Connectors
- C. Electrical Penetration Assemblies
- D. Electrical Buses
- E. Electrical Insulators
- F. Transmission Conductors
- G. Ground Conductors

VII. AUXILIARY SYSTEMS

A1. New Fuel Storage
A2. Spent Fuel Storage
A3. Spent Fuel Pool Cooling and Cleanup (PWR)
A4. Spent Fuel Pool Cooling and Cleanup (BWR)
A5. Suppression Pool Cleanup System (BWR)
B1. Light Load Handling Systems (Related to Refueling)
B2. Overhead Heavy Load Handling Systems
C1. Open Cycle Cooling Water System (Service Water System)
C2. Closed Cycle Cooling Water System
C3. Ultimate Heat Sink
D. Compressed Air System
E1. Chemical and Volume Control System (PWR)
E2. Standby Liquid Control System (BWR)
E3. Reactor Water Cleanup System (BWR)
E4. Coolant Storage/Refueling Water System (PWR)
E5. Shutdown Cooling System (Older BWR)
F1. Control Room Area Ventilation System
F2. Auxiliary and Radwaste Area Ventilation System
F3. Primary Containment Heating & Ventilation System
F4. Diesel Generator Building Ventilation System
G. Fire Protection
H1. Diesel Fuel Oil System
H2. Emergency Diesel Generator System
I. Liquid Waste Disposal System

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B1. Main Steam Systems (PWR)
B2. Main Steam System (BWR)
C. Extraction Steam System
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D2. Feedwater System (BWR)
E. Condensate System
F. Steam Generator Blowdown System (PWR)
G. Auxiliary Feedwater (AFW) System (PWR)

IX. SUMMARY AND CONCLUSIONS

APPENDIX: Quality Assurance for Aging Management Programs

DRAFT

GENERIC AGING LESSONS LEARNED

(GALL) REPORT

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

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CHAPTER II

CONTAINMENT STRUCTURES

Major Containment Structures

A. **Pressurized Water Reactor (PWR) Containments**

B. **Boiling Water Reactor (BWR) Containments**

CHAPTER II A

PRESSURIZED WATER REACTOR (PWR) CONTAINMENTS

Major PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

A2. Steel Containments

A3. Common Components

A1. Concrete Containments (Reinforced and Prestressed)

A1.1 Concrete Elements
A1.2 Steel Elements
A1.3 Prestressing System

A1. Concrete Containments (Reinforced and Prestressed)

Systems, Structures, and Components

Review Table II A addresses the elements of PWR containment structures. Reinforced and prestressed concrete containments, steel containments, and common components are discussed separately under subheadings A1, A2, and A3, respectively. This format follows the presentation format in Section 3.3 of the draft Standard Review Plan for License Renewal (SRP-LR). Concrete containments in Review Table II A1 are divided into three elements: concrete, steel, and prestressing system.

System Interfaces

Functional interfaces include the primary containment HVAC system(VII.I), containment isolation system(V.A), containment spray system(V.B), and containment heat removal system(V.C). Physical interfaces exist with any structure, system, or component which either penetrates the containment wall, such as the main steam system(VIII.A) and feedwater systems(VIII.F,VIII.G), or is supported by the containment structure, such as the polar crane(VII.K.7). The containment structure basemat typically provides support to the NSSS components and containment internal structures.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1	Concrete Elements	Dome, Wall, Basemat, Ring Girder, Buttresses	Concrete	Inside and/or Outside Contain-ment	Scaling, Cracking, Spalling	Freeze/ Thaw	10CFR50.55a ASME Section XI, Subsection IWL 10CFR50, Appendix J NUREG-1611 Draft Regulatory Guide DG-1076 ACI 201.1R-68 ACI 349.3R-96

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10CFR50.55a imposes the examination requirements of ASME B&PV Code Section XI on reinforced and prestressed concrete containments. Examination requirements of ASME Class CC concrete components are covered in Subsection IWL. Therefore, ASME Code Section XI, Subsection IWL (1992 Edition with 1992 Addenda), along with additional requirements specified in 10CFR50.55a(b)(2), constitute an existing mandated program which should be referenced by the applicant's containment inservice inspection program for managing aging of concrete containments for license renewal. NUREG-1611 identifies IWL for managing the effects of freeze/thaw, and resolves the staff's concern about concrete containment dome.	Per NUREG-1611, an application for license renewal should reference ASME Code Section XI, Subsection IWL and associated modifications/additions specified in 10CFR50.55a for managing aging of containment concrete elements and prestressing systems. In addition, an applicant should describe and justify its approach to managing the aging effects of aggressive chemical attack, leaching of calcium hydroxide, and corrosion of embedded steel/rebar, for inaccessible areas, when there are no indications of degradation for accessible areas. Evaluation of 10CFR50.55a/IWL against the ten (10) criteria for acceptable aging management program is presented below. An applicant should ensure that its implementation of 10CFR50.55a/IWL for containment concrete elements and prestressing systems is consistent with this evaluation. ***(1) Scope of Program:*** Subsection IWL-1000 specifies the components within the scope of IWL (1992 with 1992 Addenda) for concrete containments. The components within the scope of IWL are reinforced concrete and unbonded post-tensioning systems of Class CC containments, as defined by CC-1000. Steel metallic liners are governed by IWE. IWL exempts from examination portions of the concrete containment that are inaccessible (e.g. concrete covered by liner, foundation material, or backfill, or are obstructed by adjacent structures or other components). 10 CFR 50.55a(b)(2)(ix) specifies additional requirements, one of which covers inaccessible areas. It states that the licensee shall evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas. Examination requirements for containment supports are not within the scope of IWL. ***(2) Preventive Action:*** No preventive actions are specified; IWL is a monitoring program. An effective method of aging management is through monitoring and maintenance of protective coatings which inhibit degradation. Draft Regulatory Guide DG-1076 provides an acceptable basis for such a program. ***(3) Parameters Monitored or Inspected:*** Table IWL-2500-1 specifies two categories for examination of concrete surfaces. Category L-A for all concrete surfaces and Category L-B for concrete surfaces surrounding tendon anchorages. Both of these categories rely upon visual examination methods. ***(4) Detection of Aging Effects:*** The frequency and scope of examination are sufficient to ensure that aging effects are detected before the design basis requirements would be compromised. Under IWL, inservice inspections for concrete and unbonded post-tensioning systems are required at 1, 3, and 5 years following the structural integrity test. Thereafter, inspections are performed at 5 year intervals. In the case of tendons, only a sample of the tendons of each tendon type requires examination at each inspection. The tendons to be examined during an inspection are selected on a random basis. Table IWL-2521-1 specifies the number of tendons to be selected for each type (e.g. hoop, vertical, dome, helical, and	No

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	inverted U) for each inspection period. The required minimum number of each tendon type selected for inspection varies from 2 to 4 percent. Regarding the extent, all concrete surfaces receive a visual VT-3C examination. Selected areas, such as those that indicate suspect conditions and areas surrounding tendon anchorages receive a more rigorous VT-1 or VT-1C examination. ***(5) Monitoring and Trending:*** With the exception of inaccessible areas, all concrete surfaces are monitored by virtue of the examination requirements on a regular basis as described above. Trending of prestressing force in tendons is required for prestressed containments. In addition to the random sampling used for tendon examination, one tendon of each type is selected from the first year inspection sample and designated as a common tendon. Each common tendon is then examined during each inspection. This provides monitoring and trending information over the life of the plant. 10 CFR 50.55a and IWL also require that prestressing forces in all inspection sample tendons be measured by lift-off tests and compared to acceptance standards based on the predicted force for that type of tendon over its life. ***(6) Acceptance Criteria:*** IWL-3000 provides acceptance criteria for concrete containments. For concrete surfaces, the acceptance criteria rely on the determination of the Responsible Engineer whether there is any evidence of damage or degradation sufficient to warrant further evaluation or repair. Although the acceptance criteria are qualitative, guidance is provided in IWL-2510, which references ACI 201.1R-68 for identification of concrete degradation. In addition, IWL-2320 requires the Responsible Engineer to be a registered professional engineer experienced in evaluating the inservice condition of structural concrete and knowledgeable of the design and construction codes and other criteria used in design and construction of concrete containments. Alternate acceptance criteria based on ACI 349.3R is also acceptable. The acceptance standards for the unbonded post-tensioning system is quantitative in nature. For the post-tensioning system, quantitative acceptance criteria are given for tendon force, tendon wire or strand samples, and corrosion protection medium. ***(7) Corrective Actions:*** IWL specifies that items with examination results which do not meet the acceptance standards shall be evaluated to IWL-3300 "Evaluation." Items which do not meet the acceptance standards are to be evaluated by the Owner. The Owner is responsible for preparation of an Engineering Evaluation Report. The report should include an evaluation whether the concrete containment is acceptable without repair of the item and if repair is required, the extent, method, and completion date for the repair or replacement. Also included in the report is the cause of the condition and the extent, nature, and frequency of additional examinations. IWL also provides repair procedures to follow in Article IWL-4000. This includes requirements for the concrete repair, repair of reinforcing steel, repair of the post-tensioning system, and examination of the repaired area.	

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1	Concrete Elements	Dome, Wall, Basemat, Ring Girder, Buttresses	Concrete	Inside and/or Outside Contain-ment	Increase in Porosity, Permea-bility; Scaling, Cracking, Spalling	Leaching of Calcium Hydroxide; Aggressive Chemical Attack	*Same as A1.1, Freeze/Thaw Aging Mechanism*

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(8) Confirmation Process: When areas of degradation are identified, an evaluation is performed to determine if repair or replacement is necessary. As part of this evaluation, IWL-3300 requires the Engineering Evaluation Report include the extent, nature, and frequency of additional examinations. (When significant repairs on modifications are made, additional confirmation is achieved through pressure tests required by IWL and 10 CFR 50, Appendix J.) ***(9) Administrative Controls:*** An approved site QA Program would be applicable to IWL. IWA-1400 provides requirements for Owner's Responsibility. This includes responsibility for preparation of plans, schedules, and inservice inspection summary reports, and submittal of these plans and reports to the enforcement and regulatory authorities having jurisdiction at the plant site. Owner is also responsible for the preparation of written examination instructions and procedures, verification of qualification level of personnel who perform the examinations, and documentation of a Quality Assurance Program. IWA-6000 specifically covers the requirements for the preparation, submittal, and retention of records and reports. ***(10) Operating Experience:*** ASME Section XI, Subsection IWL was specifically developed to identify aging degradation of containment concrete components. Since ASME Section XI, Subsection IWL was only recently adopted by 10CFR50.55a, long term experience in managing aging of containment concrete components needs to be established. The license renewal applicant should provide plant-specific operating experience related to inservice inspection of containment and occurrences of degradation.	
Same as A1.1, Freeze/Thaw Aging Mechanism NUREG-1611 identifies 10CFR50.55a/IWL for managing the aging effects of aggressive chemical attack and leaching of calcium hydroxide, except for inaccessible areas when there are no indications of degradation for accessible areas.	*Same as A1.1, Freeze/Thaw Aging Mechanism, except inaccessible areas must be addressed.*	Yes.NUREG-1611 specifies aging management of inaccessible areas for aggressive chemical attack of concrete surfaces exposed to groundwater and for leaching of calcium hydroxide in concrete subject to flowing water. The appliant's aging management program to address this issue must be evaluated.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1	Concrete Elements	Dome, Wall, Basemat, Ring Girders, Buttresses	Concrete	Inside and/or Outside Contain-ment	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Freeze/Thaw Aging Mechanism*
A1.1	Concrete Elements	Dome, Wall, Basemat; Ring Girders, Buttresses, and Reinforcing Steel	Concrete; Carbon Steel	Inside and/or Outside Contain-ment	Cracking, Spalling, Loss of Bond, and Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Freeze/Thaw Aging Mechanism*

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/Thaw Aging Mechanism NUREG-1611 identifies 10CFR50.55a/IWL for managing the effects of reaction with aggregates, and resolves staff's concern about delayed occurrences.	*Same as A1.1, Freeze/Thaw Aging Mechanism*	No.
Same as A1.1, Freeze/Thaw Aging Mechanism NUREG-1611 identifies 10CFR50.55a/IWL for managing the effects of corrosion of embedded steel, except for inaccessible areas when there are no indications of degradation for accessible areas.	*Same as A1.1, Freeze/Thaw Aging Mechanism, except inaccessible areas must be addressed.*	Yes. NUREG-1611 specifies aging management of inaccessible areas for corrosion of embedded steel exposed to an aggressive environment. The applicant's aging management program to address this issue must be evaluated.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1	Concrete Elements	Contain-ment Structure and Basemat	Concrete	Inside and/or Outside Contain-ment	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	NUREG-1611 ACI 349.3R-96
A1.1	Concrete Elements	Dome, Wall, Basemat, Ring Girder, Buttresses	Concrete	Inside and/or Outside Contain-ment	Loss of Strength and Modulus, Change in Poisson's Ratio	Elevated Tempera-ture (>150 °F general; >200 °F local)	NUREG-1611

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
No mandated Aging Management Program exists. NUREG-1611 identifies the need for a settlement monitoring program, if the prerequisite conditions exist. ACI 349.3R-96 provides guidance for addressing settlement.	Settlement is not addressed by 10 CFR 50.55a or IWL. NUREG-1611 specifies that a settlement monitoring program is needed for a containment structure/basemat resting on soil or piles, or if the site experiences significant changes in ground water conditions.	Yes. If applicable, the applicant's aging management program to address this issue must be evaluated.
No mandated Aging Management Program exists. NUREG-1611 identifies the need for plant-specific evaluation, if the prerequisite conditions exist.	The implementation of 10 CFR 50.55a and IWL would not be able to identify the loss of strength and modulus due to elevated temperature. Thus, for any portions of concrete containment that exceed specified temperature limits, further evaluations are warranted. NUREG-1611 specifies the temperature limits, both general (150 °F) and local (200 °F), above which a plant-specific evaluation is needed.	Yes. If applicable, the applicant's aging management program to address this issue must be evaluated.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.2	Steel Elements	Liner, Liner Anchors, Structural Steel	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	10CFR50.55a ASME Section XI, Subsection IWE 10CFR50, Appendix J NUREG-1611 NRC IN 97-10 Draft Regulatory Guide DG-1076

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10CFR50.55a imposes the examination requirements of ASME B&PV Code Section XI on reinforced and prestressed concrete containments. Examination requirements of ASME Class MC pressure retaining components, metallic shell/liners of Class CC containments, integral attachments, seals and gaskets, pressure retaining bolting, and surface areas including welds are covered in Subsection IWE. Therefore, ASME Code Section XI, Subsection IWE (1992 Edition with 1992 Addenda), along with additional requirements specified in 10CFR50.55a(b)(2), constitute an existing mandated program which should be referenced by the applicant's containment inservice inspection program for managing aging of steel containments and liners of concrete containments for license renewal. NUREG-1611 identifies 10CFR50.55a/IWE for managing the effects of corrosion, except for inaccessible areas when there are no indications of degradation for accessible areas. IN 97-10 identifies specific locations where concrete containments are susceptible to liner plate corrosion. Applicants should consider these and review plant-specific operating experience to determine applicability.	Per NUREG-1611, an application for License Renewal should reference ASME Code Section XI, Subsection IWE and associated modifications/additions specified in 10 CFR50.55a for managing aging of containment steel elements. In addition, an applicant should describe and justify its approach to managing the aging effect of corrosion for inaccessible areas, when there are no indications of degradation for accessible areas. Evaluation of 10CFR50.55a/IWE against the ten (10) criteria for an acceptable aging management program is presented below. An applicant should ensure that its implementation of 10CFR50.55a/IWE for containment steel elements is consistent with this evaluation. Any relief from the requirements of IWE(1992 Edition with 1992 Addenda) which may have been granted prior to the LR Application should be identified in the application; they will be evaluated for their significance to License Renewal. ***(1) Scope of Program:*** Subsection IWE-1000 specifies the components within the scope of IWE (1992 with 1992 Addenda) for steel containments and liners of concrete containments. The components within the scope of IWE are Class MC pressure retaining components (steel containments) and their integral attachments; metallic shell and penetration liners of Class CC containments and their integral attachments; containment seals and gaskets; containment pressure retaining bolting; and surface areas, including welds and base metal. The concrete portions of containment are in accordance with IWL. IWE exempts from examination (1) components that are outside the boundaries of the containment as defined in the Design Specifications; (2) embedded or inaccessible portions of containment components that met the requirements of the original Construction Code; (3) components that become embedded or inaccessible as a result of vessel repair or replacement if IWE-1232 and IWE-5220 are met; and (4) piping, pumps, and valves that are part of the containment system, or which penetrate or are attached to the containment vessel (governed by IWB or IWC). 10 CFR 50.55a(b)(2)(x) specifies additional requirements, one of which covers inaccessible areas. It states that the licensee shall evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas. Examination requirements for containment supports are not within the scope of IWE. ***(2) Preventive Action:*** No preventive actions are specified; IWE is a monitoring program. An effective method of aging management is through monitoring and maintenance of protective coatings which inhibit degradation. Draft Regulatory Guide DG-1076 provides an acceptable basis for such a program. ***(3) Parameters Monitored or Inspected:*** Table IWE-2500-1 specifies six categories for examination. Cat. — Parts Examined — Examination Method** E-A — Containment Vessel Surface — General Visual, Visual VT-3	Yes. NUREG-1611 specifies that aging management is necessary for potential corrosion of inaccessible areas of steel liners, steel containment shells, and common steel components when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas. The applicant's aging management program to address this issue must be evaluated. Relief from the requirements of IWE (1992 Edition with 1992 Addenda) must be evaluated to determine their significance to license renewal.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

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

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	Cat. / Parts Examined / Examination Method**	
	E-B* Containment Penetration — Visual VT-1	
	E-C Containment Surfaces Requiring Augmented Examination — Visual VT-1, Volumetric	
	E-D Seals, Gaskets, and Moisture Barriers — Visual VT-3	
	E-F* Pressure Retaining Dissimilar Metal Welds — Surface	
	E-G Pressure Retaining Bolting — Visual VT-1, Bolt torque or tension test	
	E-P All Pressure Retaining Components (Pressure boundary, penetration bellows, airlocks, seals and gaskets) — 10 CFR 50, Appendix J (Containment Leak Rate Testing)	
	* These two categories are optional per 10 CFR 50.55a(b)(2)(x)(C). ** The applicable examination method (where multiple methods are listed) depends on the particular subcategory within each category. ***(4) Detection of Aging Effects:*** Examination requirements specified in 10 CFR 50.55a and IWE ensure that aging effects would be detected before they would compromise the design basis requirements because of the frequency and extent of examination. Under IWE, inservice examinations and pressure tests must be performed in accordance with one of two Inspection Programs A or B on a specified schedule. Under Inspection Program A there are four inspection intervals (at 3, 10, 27, and 40 years) for which a 100% of the required examinations must be completed. Within each interval there are various inspection periods for which a certain percentage of the examinations must be performed to reach 100% at the end of that interval. In addition, a general visual examination is performed once each inpection period. After 40 years of operation, any future examinations must be performed in accordance with the Inspection Program B. Under Inspection Program B there is an initial interval of 10 years and successive intervals of 10 years each, during which 100% of the required examinations must be completed. Regarding the extent of examination, all accessible surfaces receive a visual examination. Selected areas, such as containment surfaces requiring augmented examination (E-C) require volumetric examination. All pressure retaining components (E-P) require system leakage test in accordance with 10 CFR 50, Appendix J. ***(5) Monitoring and Trending:*** With the exception of inaccessible areas, all surfaces are monitored by virtue of the examination requirements on a scheduled basis as described above. When component examination results require evaluation of flaws, areas of degradation, or repairs and the component is found to be acceptable for continued service, the areas containing such flaws, degradation, or repairs shall be reexamined during the next inspection period, in accordance with Examination	

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	Category E-C (containment surfaces requiring augmented examination). When these reexaminations reveal that the flaws, areas of degradation, or repairs remain essentially unchanged for three consecutive inspection periods, these areas no longer require augmented examination in accordance with Examination Category E-C. IWE requires that examinations performed during any one inspection that reveal flaws or areas of degradation exceeding the acceptance standards shall be extended to include an additional number of examinations within the same category approximately equal to the initial number of examinations. When additional flaws or areas of degradation that exceed the acceptance standards are revealed, all of the remaining examinations within the same category must be performed for the inspection interval. ***(6) Acceptance Criteria:*** IWE-3000 provides acceptance criteria for metal containments and liners of concrete containments. Table IWE-3410-1 presents criteria to evaluate the acceptability of the containment components for service following the preservice examination and each inservice examination. This table specifies the acceptance standard for each Examination Category (E-A, E-B, E-C, etc.). Most of the acceptance standards rely upon an engineering evaluation or require correction by repair or replacement. For some examinations such as Augmented Examinations, numerical values are specified for the acceptance standards. For the containment steel shell or liner, a reduction of up to 10% of the wall thickness is acceptable per IWE 3512.3. ***(7) Corrective Actions:*** IWE states that components whose examination results indicate flaws or areas of degradation that do not meet the acceptance standards listed in Table-3410-1 can be considered acceptable if an engineering evaluation indicates that the flaw or area of degradation is nonstructural in nature or has no effect on the structural integrity of the containment. Components that do not meet the acceptance standards are required to satisfy additional examination requirements and the flaw or area of degradation must be removed by mechanical methods or the component repaired. For repair of components within the scope of IWE, IWE-4000 and IWE-3124 state that repairs and reexaminations shall comply with the requirements of IWA-4000. IWA-4000 provides rules and requirements for the repair of pressure retaining components including metal containments and metallic liners of concrete containments. ***(8) Confirmation Process:*** When areas of degradation are identified, an evaluation is required to determine if repair or replacement is necessary. If the evaluation determines that repair or replacement is necessary, IWE requires confirmation to ensure that appropriate corrective actions have been completed and are effective. IWE states that repairs and reexaminations shall comply with the requirements of IWA-4000. Reexaminations are required to be conducted in accordance with the requirements of IWA-2000 and the recorded results must demonstrate that the repair meets the acceptance standards set forth in Table IWE-3410-1.	

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
							10CFR50.72 10CFR50.73 10CFR50, Appendix J Regulatory Guide 1.163 NEI 94-01 ANSI/ANS 56.8-1994

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Additional confirmation of leak tightness is achieved through the pressure tests required by 10 CFR 50, Appendix J.) ***(9) Administrative Controls:*** An approved site QA Program would be applicable to IWE. IWA-1400 provides requirements for Owner's Responsibility. This includes responsibility for preparation of plans, schedules, and inservice inspection summary reports, and submittal of these plans and reports to the enforcement and regulatory authorities having jurisdiction at the plant site. Owner is also responsible for the preparation of written examination instructions and procedures, verification of qualification level of personnel who perform the examinations, and documentation of a Quality Assurance Program. IWA-6000 specifically covers the requirements for the preparation, submittal, and retention of records and reports. ***(10) Operating Experience:*** ASME Section XI, Subsection IWE was specifically developed to identify aging degradation of containment steel components. Since ASME Section XI, Subsection IWE was only recently adopted by 10CFR50.55a, long term experience in managing aging of containment components needs to be established. The license renewal applicant should provide plant-specific operating experience related to inservice inspection of containment and occurrences of degradation.	
10CFR50, Appendix J (Containment Leak Rate Tests) A containment leak rate test (LRT) program in accordance with 10 CFR 50, Appendix J is required during the extended period of operation to ensure that (1) leakage does not exceed allowable leakage rate values as specified in the technical specifications and (2) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life.	Currently there are two options, Option A and Option B, either of which can be chosen to meet the requirements of a containment LRT program. Under Option A, all of the testing must be performed on a periodic interval. Option B is a performance-based approach which eliminates the prescriptive requirements that are marginal to safety. Some of the differences between these options are discussed below and more detailed information for Option B is provided in NRC Regulatory Guide 1.163 and NEI 94-01, Rev. 0. ***(1) Scope of Program:*** The scope of the containment LRT program must include all pressure retaining passive components. Two types of tests shall be implemented. Type A tests are performed to measure leakage rates through all potential leakage paths including containment welds, valves, fittings, and components which penetrate containment. Type B tests are performed to measure local leakage rates across each pressure containing or leakage limiting boundary for containment penetrations. Type A and Type B tests defined in 10 CFR 50, Appendix J are acceptable methods for performing these leak rate tests. Leakage testing for isolation valves (normally performed under Type C tests), if not included under this program, should be included under leakage rate test programs for systems containing the isolation valves. ***(2) Preventive Actions:*** Since the containment LRT program is a monitoring program, no preventive actions are needed. ***(3) Parameters Monitored:*** The parameters to be monitored are leakage rates through containment liner/welds, penetrations, fittings, and other access openings.	No

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(4) Detection of Aging Effects: A containment LRT program is effective in detecting degradation which compromises the containment pressure boundary, including seals and gaskets. While the calculation of leakage rates demonstrates the leak-tightness and structural integrity of the containment, it does not by itself provide information which would indicate that aging degradation has initiated or that the capacity of the containment may have been reduced for other types of loads such as seismic. This would be achieved with the additional implementation of an acceptable containment inservice inspection program as described earlier. ***(5) Monitoring and Trending:*** Since the LRT program must be repeated throughout the operating license period, the entire pressure boundary is being monitored over time. The frequency of these tests depends on which option (A or B) is selected. With Option A, testing is performed on a regular fixed time interval as defined in 10 CFR 50, Appendix J. In the case of Option B, the period for testing may be extended based on acceptable performance of meeting leakage limits on prior tests. Additional details for implementing Option B are provided in NRC R.G. 1.163 and NEI 94-01, Rev.0. ***(6) Acceptance Criteria:*** Acceptance criteria for leakage rates are defined in the plant technical specifications. Acceptance criteria are acceptable if they meet the requirements in 10 CFR 50, Appendix J and are in accordance with ANSI/ANS-56.8-1994. ***(7) Corrective Actions:*** When leakage rates do not meet the acceptance criteria, corrective actions are taken in accordance with 10 CFR 50, Appendix J and NEI 94-01. If results are not acceptable, then an evaluation is required to identify the cause of the unacceptable performance and appropriate corrective actions must be taken. ***(8) Confirmation Process:*** When corrective actions are implemented to repair the condition causing the excessive leakage, confirmation by additional leak rate testing is required to confirm that the deficiency has been corrected. ***(9) Administrative Controls:*** Results of the LRT program must be documented as described in 10 CFR 50, Appendix J to demonstrate that the acceptance criteria for leakage have been satisfied. The records are required to be available for inspection at the plant site. If the test results exceed the performance criteria, then such exceedances must be assessed under 10 CFR 50.72 and 10 CFR 50.73. The quality assurance for corrective actions, confirmation process, and administrative control shall be in accordance with the plant's Quality Assurance Program. ***(10) Operating Experience:*** The plant-specific operating experience should be reviewed to ensure that the containment LRT program is effective in preventing unacceptable leakage through the containment pressure boundary. The requirements for Option B of 10 CFR 50, Appendix J should ensure that the test frequency is based on plant-specific operating experience.	

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References
							Draft Regulatory Guide DG-1076 GL 98-04 ASTM D5163-96

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program for Monitoring and Maintenance of Protective Coatings – Proper Maintenance of Coatings inside containment is essential to ensure operability of post-accident safety systems which rely on water recycled through the containment sump/drain system. Degradation of coatings can lead to clogging of strainers, which causes reduction in flow through the sump/drain system. This has been described in GL 98-04. Maintenance of protective coatings applied to carbon steel surfaces inside containment (i.e., liners, steel containment shells, penetrations and hatches) also serve to prevent or minimize loss of material due to corrosion. Draft Regulatory Guide DG-1076 provides a technical basis for a coatings monitoring and maintenance program which can be credited for managing the effects of corrosion on containment carbon steel elements. Applicants for license renewal should include a coatings monitoring and maintenance program as part of their overall program to manage aging of containment structures.	To be credited as an acceptable aging management program for License Renewal, a coatings monitoring and maintenance program must effectively address the following ten (10) criteria: ***(1) Scope of Program:*** The minimum scope of the program should be Service Level I coatings, as defined in DG-1076. Inclusion of Service Level II and III coatings in the program would enable an applicant to take credit for managing the effects of corrosion for most of the steel structural elements included within the scope of License Renewal. ***(2) Preventive Action:*** A coatings monitoring and maintenance program is itself a preventive action. ***(3) Parameters Monitored/Inspected:*** Per DG-1076, ASTM D5163-96 provides guidelines for establishing an in-service coating monitoring program for Service Level I coatings. Both coatings degradation and evidence of corrosion should be monitored. ***(4) Detection of Aging Effects:*** To be effective, visual inspection of the condition of coatings should be conducted at the beginning of each refueling outage. Early detection and timely correction of coating degradation which jeopardizes corrosion protection are key elements of an acceptable program. ***(5) Monitoring and Trending:*** Frequent visual inspection (each refueling outage) for early signs of coatings degradation will permit trending of the condition and allow for development of a timely corrective plan. ***(6) Acceptance Criteria:*** The objective of a monitoring and maintenance program for protective coating is to prevent corrosion. Therefore, evidence of corrosion of coated surfaces must be considered unacceptable, requiring corrective action to restore corrosion protection. ***(7) Corrective Action, (8) Confirmation Process and (9) Administrative Controls:*** These should be satisfied by conducting the program in accordance with the requirements of 10CFR50, Appendix B (Quality Assurance). ***(10) Operating Experience:*** In assessing the applicability of existing plant-specific coatings programs to aging management for License Renewal, an applicant should review past operating experience for that program and ascertain whether it is achieving the desired outcome; i.e., no corrosion of carbon steel structural elements. This should be discussed in the application.	Yes Applicant's program must be evaluated.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.2	Steel Elements	Liner	Carbon Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as A1.2, Corrosion Aging Mechanism*
A1.3	Prestress-ing System	Tendons and Anchorage Compo-nents	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion of Tendons/ Anchorage Components	*Same as A1.1, Freeze/Thaw Aging Mechanism* NUREG-1522 IN 99-10

II. CONTAINMENT STRUCTURES
A. PWR Containments
A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.2, Corrosion Aging Mechanism NUREG-1611 identifies stress corrosion cracking of the steel liner as non-significant.	This aging effect is not significant for the liner itself. See Item A3.1.	No.
Same as A1.1, Freeze/Thaw Aging Mechanism Note: 10CFR50.55a and IWL do not apply to bonded post-tensioning systems. NUREG-1611 identifies 10CFR50.55a/IWL for managing tendon and anchor corrosion.	*Same as A1.1, Freeze/Thaw Aging Mechanism*	No.
NUREG-1522 and IN 99-10 describe conditions in tendon access galleries conducive to corrosion of tendon anchorage components	Managing the condition and environment in the tendon access gallery (e.g., moisture and humidity) is a prudent way to manage the degradation (i.e., corrosion) of bearing plates and other vertical tendon anchorage components	Yes. Plant-specific considera-tion of the tendon access gallery should be evaluated.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.3	Prestress-ing System	Tendons and Anchorage Compo-nents	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Prestress	Relaxation; Shrinkage; Creep; Elevated Temperature	10CFR50.55a ASME Section XI, Subsection IWL NUREG-1611 10CFR54 Regulatory Guide 1.35.1 IN 99-10

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWL Note: 10CFR50.55a and IWL do not apply to bonded post-tensioning systems. NUREG-1611 identifies both 10CFR50.55a/IWL and TLAA to manage loss of prestress	Previous evaluation of 10 CFR 50.55a, IWL is augmented as follows: ***(5) Monitoring and Trending:*** 10 CFR 50.55a and IWL do not provide guidance on how to calculate expected tendon prestressing forces that are needed to compare against the measured tendon lift-off forces. This guidance is provided in NRC Regulatory Guide 1.35.1.	No, Provided Regulatory Guide 1.35.1 is followed. Otherwise plant-specific evaluation is necessary.
Tendon Surveillance Program requires TLAA.	To ensure that the structural and functional adequacy of the containment are maintained, a TLAA for the tendon prestressing forces is needed for the extended period of operation. A TLAA for the containment prestressing system which meets 10CFR54.21(c)(1)(ii) should have the following basic attributes: 1. Calculation of the minimum required prestressing force value (MRV) for each tendon group. 2. Calculated predicted lower limit (PLL) prestressing force for each group of tendons (See NRC R.G. 1.35.1). During each inspection, the measured prestressing forces in the sampled tendons are compared against the PLL. As discussed in IN 99-10, the trend lines shall be developed using a regression analysis considering individual tendon lift-off forces rather than the average lift-off forces for each group of tendons. 3. The PLL developed for the 40 year period of operation shall be extended to 60 years. The applicant has to demonstrate that the trend of the measured prestressing forces during the extended period remain above the PLL for each tendon group. If this can not be achieved, then a systematic plan of retensioning selected tendons should be developed which would result in the trend lines remaining above the PLL or a reanalysis of the containment demonstrating design adequacy is needed. If the approach described above is not feasible due to the lack of available tendon lift-off force data needed to develop trend lines, then a TLAA for containment prestressing forces performed in accordance with 10 CFR 54.21(c)(1)(iii) is acceptable. In this case, the TLAA must satisfy the ten (10) criteria for an acceptable aging management program and must specifically include the following: ***(3)Parameters Monitored:*** The parameters to be monitored are the prestressing forces in accordance with requirements specified in Subsection IWL of Section XI of the ASME Code as incorporated by reference in 10 CFR 50.55a. ***(5) Monitoring and Trending:*** The prestressing forces shall be plotted against time and trending lines developed for the period of extended operation. ***(6) Acceptance Criteria:*** The prestressing force trend lines must be shown to be above the prescribed lower limit (PLL) lines.	Yes. Methodology for TLAA must be evaluated.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References

II. CONTAINMENT STRUCTURES

A. PWR Containments

A1. Concrete Containments (Reinforced and Prestressed)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(7) Corrective Actions: If the trend lines cross the PLL at any time, then either retensioning of some tendons or a reanalysis of the containment will be needed. ***(10) Operating Experience:*** The program shall incorporate any operating experience that occurs at the plant requesting license renewal as well as other plants. Problems with the prestressing system described in NRC IN 99-10 (with the exception of temperature effects due to sun exposure) should also be incorporated into the TLAA.	

A2. Steel Containments

A2.1 Steel Elements
A2.2 Concrete Elements

A2. Steel Containments

Systems, Structures, and Components

Review Table II A addresses the elements of PWR containment structures. Reinforced and prestressed concrete containments, steel containments, and common components are discussed separately under subheadings A1, A2, and A3, respectively. This format follows the presentation format in Section 3.3 of the draft Standard Review Plan for License Renewal (SRP-LR). Steel containments in Review Table II A2 are divided into two elements: steel and concrete.

System Interfaces

Functional interfaces include the primary containment HVAC system(VII.I), containment isolation system(V.A), containment spray system(V.B), and containment heat removal system(V.C). Physical interfaces exist with any structure, system, or component which either penetrates the containment wall, such as the main steam system(VIII.A) and feedwater systems(VIII.F,VIII.G), or is supported by the containment structure, such as the polar crane(VII.K.7). The containment structure basemat typically provides support to the NSSS components and containment internal structures.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A2. Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A2.1	Steel Elements	Contain-ment Shell: Dome, Wall, Embedded Floor	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A2.1	Steel Elements	Contain-ment Shell: Dome, Wall, Embedded Floor	Carbon Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as A1.2, Stress Corrosion Cracking Aging Mechanism*

II. CONTAINMENT STRUCTURES
A. PWR Containments
A2. Steel Containments

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism*	*Same as A1.2, Corrosion Aging Mechanism*
Same as A1.2, Stress Corrosion Cracking Aging Mechanism	This aging effect is not significant for the containment shell itself. See Item A3.1.	No.

II. CONTAINMENT STRUCTURES

A. PWR Containments

A2. Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A2.2	Concrete Elements	Basemat	Concrete	Inside and/or Outside Contain-ment	Scaling, Cracking, Spalling	Freeze/ Thaw	*Same as A1.1, Freeze/Thaw Aging Mechanism*
A2.2	Concrete Elements	Basemat	Concrete	Inside and/or Outside Contain-ment	Increase in Porosity, Permea-bility; Scaling, Cracking, Spalling	Leaching of Calcium Hydroxide; Aggressive Chemical Attack	*Same as A1.1, Leaching of Calcium Hydroxide; Aggressive Chemical Attack Aging Mechanism*

II. CONTAINMENT STRUCTURES
A. PWR Containments
A2. Steel Containments

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/Thaw Aging Mechanism	*Same as A1.1, Freeze/Thaw Aging Mechanism*	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Same as A1.1, Leaching of Calcium Hydroxide; Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Leaching of Calcium Hydroxide; Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Leaching of Calcium Hydroxide; Aggressive Chemical Attack Aging Mechanism*

II. CONTAINMENT STRUCTURES
A. PWR Containments
A2. Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A2.2	Concrete Elements	Basemat	Concrete	Inside and/or Outside Contain-ment	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A2.2	Concrete Elements	Basemat and Reinforcing Steel	Concrete; Carbon Steel	Inside and/or Outside Contain-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*

II. CONTAINMENT STRUCTURES
A. PWR Containments
A2. Steel Containments

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*

II. CONTAINMENT STRUCTURES
A. PWR Containments
A2. Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A2.2	Concrete Elements	Basemat	Concrete	Inside and/or Outside Contain-ment	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as A1.1, Settlement Aging Mechanism*
A2.2	Concrete Elements	Basemat	Concrete; Carbon Steel	Inside and/or Outside Contain-ment	Loss of Strength and Modulus	Elevated Tempera-ture	*Same as A1.1, Elevated Temperature Aging Mechanism*

II. CONTAINMENT STRUCTURES
A. PWR Containments
A2. Steel Containments

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Settlement Aging Mechanism	*Same as A1.1, Settlement Aging Mechanism*	*Same as A1.1, Settlement Aging Mechanism*
Same as A1.1, Elevated Temperature Aging Mechanism	*Same as A1.1, Elevated Temperature Aging Mechanism*	*Same as A1.1, Elevated Temperature Aging Mechanism*

A3. Common Components

A3.1 Penetration Sleeves, Penetration Bellows, Dissimilar Metal Welds
A3.2 Personnel Airlock, Equipment Hatch
A3.3 Subfoundation Layer
A3.4 Seals and Gaskets

A3. Common Components

Systems, Structures, and Components

Review Table II A addresses the elements of PWR containment structures. Reinforced and prestressed concrete containments, steel containments, and common components are discussed separately under subheadings A1, A2, and A3, respectively. This format follows the presentation format in Section 3.3 of the draft Standard Review Plan for License Renewal (SRP-LR). Common components in Review Table II A3 include penetation sleeves and bellows; dissimilar metal welds; personnel airlock; equipment hatch; subfoundation layer; and seals/gaskets.

System Interfaces

Functional interfaces include the primary containment HVAC system(VII.I), containment isolation system(V.A), containment spray system(V.B), and containment heat removal system(V.C). Physical interfaces exist with any structure, system, or component which either penetrates the containment wall, such as the main steam system(VIII.A) and feedwater systems(VIII.F,VIII.G), or is supported by the containment structure, such as the polar crane(VII.K.7). The containment structure basemat typically provides support to the NSSS components and containment internal structures.

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.1	---	Penetration Sleeves, Penetration Bellows, Dissimilar Metal Welds	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A3.1	---	Penetration Sleeves, Penetration Bellows, Dissimilar Metal Welds	Carbon Steel, Stainless Steel	Inside and/or Outside Contain-ment	Cumula-tive Fatigue Damage	Cyclic Loading	NUREG-1611

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism*	*Same as A1.2, Corrosion Aging Mechanism*
NUREG-1611 identifies the need for TLAA to account for the additional number of load cycles associated with the period of extended operation.	10 CFR 50.55a, IWE, and 10 CFR 50, Appendix J do not address cumulative fatigue damage. A time-limited aging analysis (TLAA) is required for the extended period of plant operation. Current licensing basis fatigue analyses, per ASME Code, Section III, were conducted for a 40 year life. These must be updated to account for the period of extended operation. All cyclic loadings considered in the original fatigue analyses (including Type A and Type B leak rate tests) must be reevaluated and revised as necessary. The revised Cumulative Fatigue Usage Factor must not exceed 1.0.	Yes. TLAA must be evaluated.

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.1	---	Penetration Sleeves, Penetration Bellows, Dissimilar Metal Welds	Carbon Steel, Stainless Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as A1.2, Stress Corrosion Cracking Aging Mechanism* NRC IN 92-20
A3.2	---	Personnel Airlock, Equipment Hatch	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	10CFR50.55a ASME Section XI, Subsection IWE 10CFR50, Appendix J NUREG-1611

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.2, Stress Corrosion Cracking Aging Mechanism IN 92-20 describes an instance of containment bellows cracking, resulting in loss of leak tightness.	Previous evaluation of 10 CFR 50.55a, IWE is augmented as follows: ***(3) Parameters Monitored or Inspected:*** Stress corrosion cracking (SCC) is a concern wherever dissimilar welds are used and in the case of bellows assemblies if the material is not shielded from a corrosive environment. IWE covers these items under examination categories E-F and E-B. 10 CFR 50.55a identifies examination of these categories as optional during the current term of operation. If plant-specific operating experience indicates a current or potential problem with leak tightness of containment bellows, then Examination Categories E-F and E-B, and augmented VT-1 visual examinations of bellows bodies is warranted to address this issue.	Yes. Plant-specific operating experience with cracking of containment bellows should be evaluated.
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by IWE. Leak tightness will be monitored by Appendix J Leak Rate Tests.	No.

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.2	---	Personnel Airlock, Equipment Hatch	Carbon Steel	Inside and/or Outside Contain-ment	Fretting/ Lockup	Mechanical Wear of Locks/ Hinges and Closure Mechanisms	10CFR50.55a ASME Section XI, Subsection IWE 10CFR50, Appendix J
A3.3	---	Subfounda-tion Layer	Porous Concrete	Under-ground	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	NUREG-1611 NRC IN 97-11 NRC IN 98-26

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by IWE.	No.
No specific Aging Management Program exists. NUREG-1611 identifies erosion of porous concrete subfoundation as a potential aging mechanism.	Erosion of cement from porous concrete subfoundations beneath containment basemats is described in IN 97-11. IN 98-26 identifies Maintenance Rule Structures Monitoring for managing this aging effect, if applicable. (See Chapter III.A, Class 1 Structures for evaluation of Maintenance Rule Structures Monitoring)	Yes. If applicable, plant-specific evaluation is required.

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.4	---	Seals & Gaskets	Various	Inside and/or Outside Contain-ment	Loss of Sealing; Leakage Through Contain-ment	Deteriora-tion of Joint Sealants, Gaskets, O-rings	10CFR50.55a ASME Section XI, Subsection IWE 10CFR50, Appendix J

II. CONTAINMENT STRUCTURES
A. PWR Containments
A3. Common Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by IWE. Leak tightness will be monitored by Appendix J Leak Rate Tests.	No.

CHAPTER II B

BOILING WATER REACTOR (BWR) CONTAINMENTS

Draft December 6, 1999

Major BWR Containments

B1. Mark I Containments

B2. Mark II Containments

B3. Mark III Containments

B4. Common Components

B1. Mark I Containments

B1.1 Steel Containments
- B1.1.1 Steel Elements

B1.2 Concrete Containments
- B1.2.1 Concrete Elements
- B1.2.2 Steel Elements

B1. Mark I Containments

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, Mark III containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively. This format follows the presentation format in Section 3.4 of the draft Standard Review Plan for License Renewal (SRP-LR). Mark I Concrete containments in Review Table II B1 are divided into three elements: concrete, steel, and prestressing system.

System Interfaces

Functional interfaces include the primary containment HVAC system(VII.I), containment isolation system(V.A), containment spray system(V.B), and containment heat removal system(V.C). Physical interfaces exist with any structure, system, or component which either penetrates the containment wall, such as the main steam system(VIII.A) and feedwater systems(VIII.F,VIII.G), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.1 Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.1.1	Steel Elements	Drywell; Torus; Drywell Head; Embedded Shell and Sand Pocket Regions; Drywell Support Skirt; Torus Ring Girder, Seismic Restraints, and Support Saddles/ Columns; Vent Lines, Header, and System Supports; Down-comers and Bracing; ECCS Suction Header	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	10CFR50.55a ASME Section XI, Subsection IWE 10CFR50, Appendix J NUREG-1611 Draft Regulatory Guide DG-1076

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10CFR50.55a imposes the examination requirements of ASME B&PV Code Section XI on reinforced and prestressed concrete containments. Examination requirements of ASME Class MC pressure retaining components, metallic shell/liners of Class CC containments, integral attachments, seals and gaskets, pressure retaining bolting, and surface areas including welds are covered in Subsection IWE. Therefore, ASME Code Section XI, Subsection IWE (1992 Edition with 1992 Addenda), along with additional requirements specified in 10CFR50.55a(b)(2), constitute an existing mandated program which should be referenced by the applicant's containment inservice inspection program for managing aging of steel containments and liners of concrete containments for license renewal. NUREG-1611 identifies 10CFR50.55a/IWE for managing the effects of corrosion, except for inaccessible areas when there are no indications of degradation for accessible areas. Note: Inspection of supports, restraints and bracing for containment components is addressed by Subsection IWF of ASME Code, Section XI. See Chapter III B – Component Supports for evaluation of IWF as an aging management program.	Per NUREG-1611, an application for License Renewal should reference ASME Code Section XI, Subsection IWE and associated modifications/additions specified in 10 CFR50.55a for managing aging of containment steel elements. In addition, an applicant should describe and justify its approach to managing the aging effect of corrosion for inaccessible areas, when there are no indications of degradation for accessible areas. Evaluation of 10CFR50.55a/IWE against the ten (10) criteria for an acceptable aging management program is presented below. An applicant should ensure that its implementation of 10CFR50.55a/IWE for containment steel elements is consistent with this evaluation. Any relief from the requirements of IWE(1992 Edition with 1992 Addenda) which may have been granted prior to the LR Application should be identified in the application; they will be evaluated for their significance to License Renewal. ***(1) Scope of Program:*** Subsection IWE-1000 specifies the components within the scope of IWE (1992 with 1992 Addenda) for steel containments and liners of concrete containments. The components within the scope of IWE are Class MC pressure retaining components (steel containments) and their integral attachments; metallic shell and penetration liners of Class CC containments and their integral attachments; containment seals and gaskets; containment pressure retaining bolting; and surface areas, including welds and base metal. The concrete portions of containment are in accordance with IWL. IWE exempts from examination (1) components that are outside the boundaries of the containment as defined in the Design Specifications; (2) embedded or inaccessible portions of containment components that met the requirements of the original Construction Code; (3) components that become embedded or inaccessible as a result of vessel repair or replacement if IWE-1232 and IWE-5220 are met; and (4) piping, pumps, and valves that are part of the containment system, or which penetrate or are attached to the containment vessel (governed by IWB or IWC). 10 CFR 50.55a(b)(2)(x) specifies additional requirements, one of which covers inaccessible areas. It states that the licensee shall evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas. Examination requirements for containment supports are not within the scope of IWE. ***(2) Preventive Action:*** No preventive actions are specified; IWE is a monitoring program. An effective method of aging management is through monitoring and maintenance of protective coatings which inhibit degradation. Draft Regulatory Guide DG-1076 provides an acceptable basis for such a program. ***(3) Parameters Monitored or Inspected:*** Table IWE-2500-1 specifies six categories for examination. Cat. — Parts Examined — Examination Method** E-A — Containment Vessel Surface — General Visual, Visual VT-3	Yes. NUREG-1611 specifies that aging management is necessary for potential corrosion of inaccessible areas of steel liners, steel containment shells, and common steel components when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas. The applicant's aging management program to address this issue must be evaluated. Relief from the requirements of IWE (1992 Edition with 1992 Addenda) must be evaluated to determine their significance to license renewal.

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.1 Steel Containments

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	Cat. / Parts Examined / Examination Method** E-B* / Containment Penetration / Visual VT-1 E-C / Containment Surfaces Requiring Augmented Examination / Visual VT-1, Volumetric E-D / Seals, Gaskets, and Moisture Barriers / Visual VT-3 E-F* / Pressure Retaining Dissimilar Metal Welds / Surface E-G / Pressure Retaining Bolting / Visual VT-1, Bolt torque or tension test E-P / All Pressure Retaining Components (Pressure boundary, penetration bellows, airlocks, seals and gaskets) / 10 CFR 50, Appendix J (Containment Leak Rate Testing) * These two categories are optional per 10 CFR 50.55a(b)(2)(x)(C). ** The applicable examination method (where multiple methods are listed) depends on the particular subcategory within each category. ***(4) Detection of Aging Effects:*** Examination requirements specified in 10 CFR 50.55a and IWE ensure that aging effects would be detected before they would compromise the design basis requirements because of the frequency and extent of examination. Under IWE, inservice examinations and pressure tests must be performed in accordance with one of two Inspection Programs A or B on a specified schedule. Under Inspection Program A there are four inspection intervals (at 3, 10, 27, and 40 years) for which a 100% of the required examinations must be completed. Within each interval there are various inspection periods for which a certain percentage of the examinations must be performed to reach 100% at the end of that interval. In addition, a general visual examination is performed once each inpection period. After 40 years of operation, any future examinations must be performed in accordance with the Inspection Program B. Under Inspection Program B there is an initial interval of 10 years and successive intervals of 10 years each, during which 100% of the required examinations must be completed. Regarding the extent of examination, all accessible surfaces receive a visual examination. Selected areas, such as containment surfaces requiring augmented examination (E-C) require volumetric examination. All pressure retaining components (E-P) require system leakage test in accordance with 10 CFR 50, Appendix J. ***(5) Monitoring and Trending:*** With the exception of inaccessible areas, all surfaces are monitored by virtue of the examination requirements on a scheduled basis as described above. When component examination results require evaluation of flaws, areas of degradation, or repairs and the component is found to be acceptable for continued service, the areas containing such flaws, degradation, or repairs shall be reexamined during the next inspection period, in accordance with Examination	

II CONTAINMENT STRUCTURES

B BWR Containments

B1 Mark I Containments

B1.1 Steel Containments

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	Category E-C (containment surfaces requiring augmented examination). When these reexaminations reveal that the flaws, areas of degradation, or repairs remain essentially unchanged for three consecutive inspection periods, these areas no longer require augmented examination in accordance with Examination Category E-C. IWE requires that examinations performed during any one inspection that reveal flaws or areas of degradation exceeding the acceptance standards shall be extended to include an additional number of examinations within the same category approximately equal to the initial number of examinations. When additional flaws or areas of degradation that exceed the acceptance standards are revealed, all of the remaining examinations within the same category must be performed for the inspection interval. ***(6) Acceptance Criteria:*** IWE-3000 provides acceptance criteria for metal containments and liners of concrete containments. Table IWE-3410-1 presents criteria to evaluate the acceptability of the containment components for service following the preservice examination and each inservice examination. This table specifies the acceptance standard for each Examination Category (E-A, E-B, E-C, etc.). Most of the acceptance standards rely upon an engineering evaluation or require correction by repair or replacement. For some examinations such as Augmented Examinations, numerical values are specified for the acceptance standards. For the containment steel shell or liner, a reduction of up to 10% of the wall thickness is acceptable per IWE 3512.3. ***(7) Corrective Actions:*** IWE states that components whose examination results indicate flaws or areas of degradation that do not meet the acceptance standards listed in Table-3410-1 can be considered acceptable if an engineering evaluation indicates that the flaw or area of degradation is nonstructural in nature or has no effect on the structural integrity of the containment. Components that do not meet the acceptance standards are required to satisfy additional examination requirements and the flaw or area of degradation must be removed by mechanical methods or the component repaired. For repair of components within the scope of IWE, IWE-4000 and IWE-3124 state that repairs and reexaminations shall comply with the requirements of IWA-4000. IWA-4000 provides rules and requirements for the repair of pressure retaining components including metal containments and metallic liners of concrete containments. ***(8) Confirmation Process:*** When areas of degradation are identified, an evaluation is required to determine if repair or replacement is necessary. If the evaluation determines that repair or replacement is necessary, IWE requires confirmation to ensure that appropriate corrective actions have been completed and are effective. IWE states that repairs and reexaminations shall comply with the requirements of IWA-4000. Reexaminations are required to be conducted in accordance with the requirements of IWA-2000 and the recorded results must demonstrate that the repair meets the acceptance standards set forth in Table IWE-3410-1.	

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.1 Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
							10CFR50.72 10CFR50.73 10CFR50, Appendix J Regulatory Guide 1.163 NEI 94-01 ANSI/ANS 56.8-1994

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(Additional confirmation of leak tightness is achieved through the pressure tests required by 10 CFR 50, Appendix J.) ***(9) Administrative Controls:*** An approved site QA Program would be applicable to IWE. IWA-1400 provides requirements for Owner's Responsibility. This includes responsibility for preparation of plans, schedules, and inservice inspection summary reports, and submittal of these plans and reports to the enforcement and regulatory authorities having jurisdiction at the plant site. Owner is also responsible for the preparation of written examination instructions and procedures, verification of qualification level of personnel who perform the examinations, and documentation of a Quality Assurance Program. IWA-6000 specifically covers the requirements for the preparation, submittal, and retention of records and reports. ***(10) Operating Experience:*** ASME Section XI, Subsection IWE was specifically developed to identify aging degradation of containment steel components. Since ASME Section XI, Subsection IWE was only recently adopted by 10CFR50.55a, long term experience in managing aging of containment components needs to be established. The license renewal applicant should provide plant-specific operating experience related to inservice inspection of containment and occurrences of degradation.	
10CFR50, Appendix J (Containment Leak Rate Tests) A containment leak rate test (LRT) program in accordance with 10 CFR 50, Appendix J is required during the extended period of operation to ensure that (1) leakage does not exceed allowable leakage rate values as specified in the technical specifications and (2) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life.	Currently there are two options, Option A and Option B, either of which can be chosen to meet the requirements of a containment LRT program. Under Option A, all of the testing must be performed on a periodic interval. Option B is a performance-based approach which eliminates the prescriptive requirements that are marginal to safety. Some of the differences between these options are discussed below and more detailed information for Option B is provided in NRC Regulatory Guide 1.163 and NEI 94-01, Rev. 0. ***(1) Scope of Program:*** The scope of the containment LRT program must include all pressure retaining passive components. Two types of tests shall be implemented. Type A tests are performed to measure leakage rates through all potential leakage paths including containment welds, valves, fittings, and components which penetrate containment. Type B tests are performed to measure local leakage rates across each pressure containing or leakage limiting boundary for containment penetrations. Type A and Type B tests defined in 10 CFR 50, Appendix J are acceptable methods for performing these leak rate tests. Leakage testing for isolation valves (normally performed under Type C tests), if not included under this program, should be included under leakage rate test programs for systems containing the isolation valves. ***(2) Preventive Actions:*** Since the containment LRT program is a monitoring program, no preventive actions are needed. ***(3) Parameters Monitored:*** The parameters to be monitored are leakage rates through containment liner/welds, penetrations, fittings, and other access openings.	No

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.1 Steel Containments

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(4) Detection of Aging Effects: A containment LRT program is effective in detecting degradation which compromises the containment pressure boundary, including seals and gaskets. While the calculation of leakage rates demonstrates the leak-tightness and structural integrity of the containment, it does not by itself provide information which would indicate that aging degradation has initiated or that the capacity of the containment may have been reduced for other types of loads such as seismic. This would be achieved with the additional implementation of an acceptable containment inservice inspection program as described earlier. ***(5) Monitoring and Trending:*** Since the LRT program must be repeated throughout the operating license period, the entire pressure boundary is being monitored over time. The frequency of these tests depends on which option (A or B) is selected. With Option A, testing is performed on a regular fixed time interval as defined in 10 CFR 50, Appendix J. In the case of Option B, the period for testing may be extended based on acceptable performance of meeting leakage limits on prior tests. Additional details for implementing Option B are provided in NRC R.G. 1.163 and NEI 94-01, Rev.0. ***(6) Acceptance Criteria:*** Acceptance criteria for leakage rates are defined in the plant technical specifications. Acceptance criteria are acceptable if they meet the requirements in 10 CFR 50, Appendix J and are in accordance with ANSI/ANS-56.8-1994. ***(7) Corrective Actions:*** When leakage rates do not meet the acceptance criteria, corrective actions are taken in accordance with 10 CFR 50, Appendix J and NEI 94-01. If results are not acceptable, then an evaluation is required to identify the cause of the unacceptable performance and appropriate corrective actions must be taken. ***(8) Confirmation Process:*** When corrective actions are implemented to repair the condition causing the excessive leakage, confirmation by additional leak rate testing is required to confirm that the deficiency has been corrected. ***(9) Administrative Controls:*** Results of the LRT program must be documented as described in 10 CFR 50, Appendix J to demonstrate that the acceptance criteria for leakage have been satisfied. The records are required to be available for inspection at the plant site. If the test results exceed the performance criteria, then such exceedances must be assessed under 10 CFR 50.72 and 10 CFR 50.73. The quality assurance for corrective actions, confirmation process, and administrative control shall be in accordance with the plant's Quality Assurance Program. ***(10) Operating Experience:*** The plant-specific operating experience should be reviewed to ensure that the containment LRT program is effective in preventing unacceptable leakage through the containment pressure boundary. The requirements for Option B of 10 CFR 50, Appendix J should ensure that the test frequency is based on plant-specific operating experience.	

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.1 Steel Containments

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References
							Draft Regulatory Guide DG-1076 GL 98-04 ASTM D5163-96

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Program for Monitoring and Maintenance of Protective Coatings – Proper Maintenance of Coatings inside containment is essential to ensure operability of post-accident safety systems which rely on water recycled through the containment sump/drain system. Degradation of coatings can lead to clogging of strainers, which causes reduction in flow through the sump/drain system. This has been described in GL 98-04. Maintenance of protective coatings applied to carbon steel surfaces inside containment (i.e., liners, steel containment shells, penetrations and hatches) also serve to prevent or minimize loss of material due to corrosion. Draft Regulatory Guide DG-1076 provides a technical basis for a coatings monitoring and maintenance program which can be credited for managing the effects of corrosion on containment carbon steel elements. Applicants for license renewal should include a coatings monitoring and maintenance program as part of their overall program to manage aging of containment structures.	To be credited as an acceptable aging management program for License Renewal, a coatings monitoring and maintenance program must effectively address the following ten (10) criteria: ***(1) Scope of Program:*** The minimum scope of the program should be Service Level I coatings, as defined in DG-1076. Inclusion of Service Level II and III coatings in the program would enable an applicant to take credit for managing the effects of corrosion for most of the steel structural elements included within the scope of License Renewal. ***(2) Preventive Action:*** A coatings monitoring and maintenance program is itself a preventive action. ***(3) Parameters Monitored/Inspected:*** Per DG-1076, ASTM D5163-96 provides guidelines for establishing an in-service coating monitoring program for Service Level I coatings. Both coatings degradation and evidence of corrosion should be monitored. ***(4) Detection of Aging Effects:*** To be effective, visual inspection of the condition of coatings should be conducted at the beginning of each refueling outage. Early detection and timely correction of coating degradation which jeopardizes corrosion protection are key elements of an acceptable program. ***(5) Monitoring and Trending:*** Frequent visual inspection (each refueling outage) for early signs of coatings degradation will permit trending of the condition and allow for development of a timely corrective plan. ***(6) Acceptance Criteria:*** The objective of a monitoring and maintenance program for protective coating is to prevent corrosion. Therefore, evidence of corrosion of coated surfaces must be considered unacceptable, requiring corrective action to restore corrosion protection. ***(7) Corrective Action, (8) Confirmation Process and (9) Administrative Controls:*** These should be satisfied by conducting the program in accordance with the requirements of 10CFR50, Appendix B (Quality Assurance). ***(10) Operating Experience:*** In assessing the applicability of existing plant-specific coatings programs to aging management for License Renewal, an applicant should review past operating experience for that program and ascertain whether it is achieving the desired outcome; i.e., no corrosion of carbon steel structural elements. This should be discussed in the application.	Yes Applicant's program must be evaluated.

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.1 Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.1.1	Steel Elements	Vent Line Bellows	Stainless Steel	Inside and/or Outside Contain-ment	Cumula-tive Fatigue Damage	Cyclic Loading	NUREG-1611
B1.1.1	Steel Elements	Vent Line Bellows	Stainless Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as B1.1.1, Corrosion Aging Mechanism* IN 92-20
B1.1.1	Steel Elements	Drywell Head; Down-comers and Bracing; Vent System Supports; Torus Seismic Restraints; Torus Support Column/ Saddle	Carbon Steel and Graphite Plate	Inside and/or Outside Contain-ment	Fretting/ Lockup	Mechanical Wear	10CFR50.55a ASME Section XI, Subsection IWE 10CFR50, Appendix J

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
NUREG-1611 identifies the need for TLAA to account for the additional number of load cycles associated with the period of extended operation.	10 CFR 50.55a, IWE, and 10 CFR 50, Appendix J do not address cumulative fatigue damage. A time-limited aging analysis (TLAA) is required for the extended period of plant operation. Current licensing basis fatigue analyses, per ASME Code, Section III, were conducted for a 40 year life. These must be updated to account for the period of extended operation. All cyclic loadings considered in the original fatigue analyses (including Type A and Type B leak rate tests) must be reevaluated and revised as necessary. The revised Cumulative Fatigue Usage Factor must not exceed 1.0.	Yes. TLAA must be evaluated.
Same as B1.1.1, Corrosion Aging Mechanism IN 92-20 describes an instance of containment bellows cracking, resulting in loss of leak tightness.	Previous evaluation of 10 CFR 50.55a, IWE is augmented as follows: ***(3) Parameters Monitored or Inspected:*** Stress corrosion cracking (SCC) is a concern wherever dissimilar welds are used and in the case of bellows assemblies if the material is not shielded from a corrosive environment. IWE covers these items under examination categories E-F and E-B. 10 CFR 50.55a identifies examination of these categories as optional during the current term of operation. If plant-specific operating experience indicates a current or potential problem with leak tightness of containment bellows, then Examination Categories E-F and E-B, and augmented VT-1 visual examinations of bellows bodies is warranted to address this issue.	Yes. Plant-specific operating experience with cracking of contain-ment bellows should be evaluated.
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by IWE.	No.

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.2 Concrete Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.2.1	Concrete Elements	Drywell; Torus	Concrete	Inside and/or Outside Contain-ment	Increase in Porosity, Permea-bility; Scaling, Cracking, Spalling	Leaching of Calcium Hydroxide; Aggressive Chemical Attack	10CFR50.55a ASME Section XI, Subsection IWL 10CFR50, Appendix J NUREG-1611 Draft Regulatory Guide DG-1076 ACI 201.1R-68 ACI 349.3R-96

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10CFR50.55a imposes the examination requirements of ASME B&PV Code Section XI on reinforced and prestressed concrete containments. Examination requirements of ASME Class CC concrete components are covered in Subsection IWL. Therefore, ASME Code Section XI, Subsection IWL (1992 Edition with 1992 Addenda), along with additional requirements specified in 10CFR50.55a(b)(2), constitute an existing mandated program which should be referenced by the applicant's containment inservice inspection program for managing aging of concrete containments for license renewal. NUREG-1611 identifies 10CFR50.55a/IWL for managing the aging effects of aggressive chemical attack and leaching of calcium hydroxide, except for inaccessible areas when there are no indications of degradation for accessible areas.	Per NUREG-1611, an application for license renewal should reference ASME Code Section XI, Subsection IWL and associated modifications/additions specified in 10CFR50.55a for managing aging of containment concrete elements and prestressing systems. In addition, an applicant should describe and justify its approach to managing the aging effects of aggressive chemical attack, leaching of calcium hydroxide, and corrosion of embedded steel/rebar, for inaccessible areas, when there are no indications of degradation for accessible areas. Evaluation of 10CFR50.55a/IWL against the ten (10) criteria for acceptable aging management program is presented below. An applicant should ensure that its implementation of 10CFR50.55a/IWL for containment concrete elements and prestressing systems is consistent with this evaluation. ***(1) Scope of Program:*** Subsection IWL-1000 specifies the components within the scope of IWL (1992 with 1992 Addenda) for concrete containments. The components within the scope of IWL are reinforced concrete and unbonded post-tensioning systems of Class CC containments, as defined by CC-1000. Steel metallic liners are governed by IWE. IWL exempts from examination portions of the concrete containment that are inaccessible (e.g. concrete covered by liner, foundation material, or backfill, or are obstructed by adjacent structures or other components). 10 CFR 50.55a(b)(2)(ix) specifies additional requirements, one of which covers inaccessible areas. It states that the licensee shall evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas. Examination requirements for containment supports are not within the scope of IWL. ***(2) Preventive Action:*** No preventive actions are specified; IWL is a monitoring program. An effective method of aging management is through monitoring and maintenance of protective coatings which inhibit degradation. Draft Regulatory Guide DG-1076 provides an acceptable basis for such a program. ***(3) Parameters Monitored or Inspected:*** Table IWL-2500-1 specifies two categories for examination of concrete surfaces. Category L-A for all concrete surfaces and Category L-B for concrete surfaces surrounding tendon anchorages. Both of these categories rely upon visual examination methods. ***(4) Detection of Aging Effects:*** The frequency and scope of examination are sufficient to ensure that aging effects are detected before the design basis requirements would be compromised. Under IWL, inservice inspections for concrete and unbonded post-tensioning systems are required at 1, 3, and 5 years following the structural integrity test. Thereafter, inspections are performed at 5 year intervals. In the case of tendons, only a sample of the tendons of each tendon type requires examination at each inspection. The tendons to be examined during an inspection are selected on a random basis. Table IWL-2521-1 specifies the number of tendons to be selected for each type (e.g. hoop, vertical, dome, helical, and	Yes. NUREG-1611 specifies aging management of inaccessible areas for aggressive chemical attack of concrete surfaces exposed to groundwater and for leaching of calcium hydroxide in concrete subject to flowing water. The appliant's aging management program to address this issue must be evaluated.

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.2 Concrete Containments

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	inverted U) for each inspection period. The required minimum number of each tendon type selected for inspection varies from 2 to 4 percent. Regarding the extent, all concrete surfaces receive a visual VT-3C examination. Selected areas, such as those that indicate suspect conditions and areas surrounding tendon anchorages receive a more rigorous VT-1 or VT-1C examination. ***(5) Monitoring and Trending:*** With the exception of inaccessible areas, all concrete surfaces are monitored by virtue of the examination requirements on a regular basis as described above. Trending of prestressing force in tendons is required for prestressed containments. In addition to the random sampling used for tendon examination, one tendon of each type is selected from the first year inspection sample and designated as a common tendon. Each common tendon is then examined during each inspection. This provides monitoring and trending information over the life of the plant. 10 CFR 50.55a and IWL also require that prestressing forces in all inspection sample tendons be measured by lift-off tests and compared to acceptance standards based on the predicted force for that type of tendon over its life. ***(6) Acceptance Criteria:*** IWL-3000 provides acceptance criteria for concrete containments. For concrete surfaces, the acceptance criteria rely on the determination of the Responsible Engineer whether there is any evidence of damage or degradation sufficient to warrant further evaluation or repair. Although the acceptance criteria are qualitative, guidance is provided in IWL-2510, which references ACI 201.1R-68 for identification of concrete degradation. In addition, IWL-2320 requires the Responsible Engineer to be a registered professional engineer experienced in evaluating the inservice condition of structural concrete and knowledgeable of the design and construction codes and other criteria used in design and construction of concrete containments. Alternate acceptance criteria based on ACI 349.3R is also acceptable. The acceptance standards for the unbonded post-tensioning system is quantitative in nature. For the post-tensioning system, quantitative acceptance criteria are given for tendon force, tendon wire or strand samples, and corrosion protection medium. ***(7) Corrective Actions:*** IWL specifies that items with examination results which do not meet the acceptance standards shall be evaluated to IWL-3300 "Evaluation." Items which do not meet the acceptance standards are to be evaluated by the Owner. The Owner is responsible for preparation of an Engineering Evaluation Report. The report should include an evaluation whether the concrete containment is acceptable without repair of the item and if repair is required, the extent, method, and completion date for the repair or replacement. Also included in the report is the cause of the condition and the extent, nature, and frequency of additional examinations. IWL also provides repair procedures to follow in Article IWL-4000. This includes requirements for the concrete repair, repair of reinforcing steel, repair of the post-tensioning system, and examination of the repaired area.	

II CONTAINMENT STRUCTURES

B BWR Containments

B1 Mark I Containments

B1.2 Concrete Containments

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(8) Confirmation Process: When areas of degradation are identified, an evaluation is performed to determine if repair or replacement is necessary. As part of this evaluation, IWL-3300 requires the Engineering Evaluation Report include the extent, nature, and frequency of additional examinations. (When significant repairs on modifications are made, additional confirmation is achieved through pressure tests required by IWL and 10 CFR 50, Appendix J.) ***(9) Administrative Controls:*** An approved site QA Program would be applicable to IWL. IWA-1400 provides requirements for Owner's Responsibility. This includes responsibility for preparation of plans, schedules, and inservice inspection summary reports, and submittal of these plans and reports to the enforcement and regulatory authorities having jurisdiction at the plant site. Owner is also responsible for the preparation of written examination instructions and procedures, verification of qualification level of personnel who perform the examinations, and documentation of a Quality Assurance Program. IWA-6000 specifically covers the requirements for the preparation, submittal, and retention of records and reports. ***(10) Operating Experience:*** ASME Section XI, Subsection IWL was specifically developed to identify aging degradation of containment concrete components. Since ASME Section XI, Subsection IWL was only recently adopted by 10CFR50.55a, long term experience in managing aging of containment concrete components needs to be established. The license renewal applicant should provide plant-specific operating experience related to inservice inspection of containment and occurrences of degradation.	

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.2.1	Concrete Elements	Drywell; Torus	Concrete	Inside and/or Outside Contain-ment	Expansion & Cracking	Reaction with Aggregates	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*
B1.2.1	Concrete Elements	Drywell; Torus, and Reinforcing Steel	Concrete, Carbon Steel	Inside and/or Outside Contain-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*
B1.2.1	Concrete Elements	Drywell; Torus	Concrete	Inside and/or Outside Contain-ment	Loss of Strength and Modulus, Change in Poisson's Ratio	Elevated Tempera-ture (>150 °F general; >200 °F local)	NUREG-1611

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism NUREG-1611 identifies 10CFR50.55a/IWL for managing the effects of reaction with aggregates, and resolves staff's concern about delayed occurrences.	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*	No.
Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism NUREG-1611 identifies 10CFR50.55a/IWL for managing the effects of corrosion of embedded steel, except for inaccessible areas when there are no indications of degradation for accessible areas.	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism, except inaccessible areas must be addressed.*	Yes. NUREG-1611 specifies aging management of inaccessible areas for corrosion of embedded steel exposed to an aggressive environment. The applicant's aging management program to address this issue must be evaluated.
No mandated Aging Management Program exists. NUREG-1611 identifies the need for plant-specific evaluation, if the prerequisite conditions exist.	The implementation of 10 CFR 50.55a and IWL would not be able to identify the loss of strength and modulus due to elevated temperature. Thus, for any portions of concrete containment that exceed specified temperature limits, further evaluations are warranted. NUREG-1611 specifies the temperature limits, both general (150 °F) and local (200 °F), above which a plant-specific evaluation is needed.	Yes. If applicable, the applicant's aging management program to address this issue must be evaluated.

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.2.2	Steel Elements	Drywell Liner; Torus Liner; Liner Anchors; Drywell Head; Vent Lines, Header, and System Supports; Down-comers and Bracing	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as B1.1.1, Corrosion Aging Mechanism* NRC IN 97-10
B1.2.2	Steel Elements	Vent Line Bellows	Stainless Steel	Inside and/or Outside Contain-ment	Cumula-tive Fatigue Damage	Cyclic Loading	*Same as B1.1.1, Cyclic Loading Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Corrosion Aging Mechanism IN 97-10 identifies specific locations where concrete containments are susceptible to liner plate corrosion. Applicants should consider these and review plant-specific operating experience to determine applicability.	*Same as B1.1.1, Corrosion Aging Mechanism*	*Same as B1.1.1, Corrosion Aging Mechanism*
Same as B1.1.1, Cyclic Loading Aging Mechanism	*Same as B1.1.1, Cyclic Loading Aging Mechanism*	*Same as B1.1.1, Cyclic Loading Aging Mechanism*

II CONTAINMENT STRUCTURES
B BWR Containments
B1 Mark I Containments
B1.2 Concrete Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.2.2	Steel Elements	Vent Line Bellows	Stainless Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*
B1.2.2	Steel Elements	Drywell Head; Down-comers and Bracing; Vent System Supports	Carbon Steel	Inside and/or Outside Contain-ment	Fretting/ Lockup	Mechanical Wear	*Same as B1.1.1, Mechanical Wear Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*
Same as B1.1.1, Mechanical Wear Aging Mechanism	*Same as B1.1.1, Mechanical Wear Aging Mechanism*	*Same as B1.1.1, Mechanical Wear Aging Mechanism*

B2. Mark II Containments

B2.1 Steel Containments
- B2.1.1 Steel Elements

B2.2 Concrete Containments
- B2.2.1 Concrete Elements
- B2.2.2 Steel Elements
- B2.2.3 Prestressing System

B2. Mark II Containments

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, Mark III containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively. This format follows the presentation format in Section 3.4 of the draft Standard Review Plan for License Renewal (SRP-LR). In Review Table II B2, Mark II Concrete containments are divided into three elements: concrete, steel, and prestressing system and Mark II Steel containments are divided into two elements: steel and concrete.

System Interfaces

Functional interfaces include the primary containment HVAC system(VII.I), containment isolation system(V.A), containment spray system(V.B), and containment heat removal system(V.C). Physical interfaces exist with any structure, system, or component which either penetrates the containment wall, such as the main steam system(VIII.A) and feedwater systems(VIII.F,VIII.G), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

II CONTAINMENT STRUCTURES
B BWR Containments
B2 Mark II Containments
B2.1 Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.1.1	Steel Elements	Drywell; Suppres-sion Chamber; Drywell Head; Embedded Shell and Sand Pocket Regions; Support Skirt; Downcomer Pipes & Bracing; Region Shielded by Diaphragm Floor	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as B1.1.1, Corrosion Aging Mechanism*
B2.1.1	Steel Elements	Drywell Head; Downcomer Pipes & Bracing	Carbon Steel	Inside and/or Outside Contain-ment	Fretting/ Lockup	Mechanical Wear	*Same as B1.1.1, Mechanical Wear Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Corrosion Aging Mechanism	*Same as B1.1.1, Corrosion Aging Mechanism*	*Same as B1.1.1, Corrosion Aging Mechanism*
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by IWE.	No.

II CONTAINMENT STRUCTURES
B BWR Containments
B2 Mark II Containments
B2.2 Concrete Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.2.1	Concrete Elements	Contain-ment; Basemat	Concrete	Inside and/or Outside Contain-ment	Increase in Porosity, Permea-bility; Scaling, Cracking, Spalling	Leaching of Calcium Hydroxide; Aggressive Chemical Attack	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*
B2.2.1	Concrete Elements	Contain-ment; Basemat	Concrete	Inside and/or Outside Contain-ment	Expansion & Cracking	Reaction with Aggregates	*Same as B1.2.1, Reaction with Aggregates Aging Mechanism*
B2.2.1	Concrete Elements	Contain-ment; Basemat; Reinforcing Steel	Concrete; Carbon Steel	Inside and/or Outside Contain-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*
Same as B1.2.1, Reaction with Aggregates Aging Mechanism	*Same as B1.2.1, Reaction with Aggregates Aging Mechanism*	No
Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*

II CONTAINMENT STRUCTURES
B BWR Containments
B2 Mark II Containments
B2.2 Concrete Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.2.1	Concrete Elements	Basemat	Concrete	Inside and/or Outside Contain-ment	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	NUREG-1611
B2.2.1	Concrete Elements	Contain-ment; Concrete Fill in Annulus; Basemat	Concrete	Inside and/or Outside Contain-ment	Loss of Strength and Modulus	Elevated Tempera-ture	*Same as B1.2.1, Elevated Temperature Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
No mandated Aging Management Program exists. NUREG-1611 identifies the need for a settlement monitoring program, if the prerequisite conditions exist. ACI 349.3R-96 provides guidance for addressing settlement.	Settlement is not addressed by 10 CFR 50.55a or IWL. NUREG-1611 specifies that a settlement monitoring program is needed for a containment structure/basemat resting on soil or piles, or if the site experiences significant changes in ground water conditions.	Yes. If applicable, the applicant's aging management program to address this issue must be evaluated.
Same as B1.2.1, Elevated Temperature Aging Mechanism	*Same as B1.2.1, Elevated Temperature Aging Mechanism*	*Same as B1.2.1, Elevated Temperature Aging Mechanism*

II CONTAINMENT STRUCTURES
B BWR Containments
B2 Mark II Containments
B2.2 Concrete Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.2.2	Steel Elements	Drywell, Suppres-sion Chamber and Basemat Liners; Liner Anchors; Drywell Head; Downcomer Pipes & Bracing	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as B1.2.2, Corrosion Aging Mechanism*
B2.2.2	Steel Elements	Suppres-sion Chamber Liner (Interior Surface)	Stainless Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.2.2, Corrosion Aging Mechanism	*Same as B1.2.2, Corrosion Aging Mechanism*	*Same as B1.2.2, Corrosion Aging Mechanism*
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by Examination Category E-P (10 CFR 50, Appendix J, Integrated Leak Rate Test).	No.

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.2.2	Steel Elements	Drywell Head; Downcomer Pipes & Bracing	Carbon Steel	Inside and/or Outside Contain-ment	Fretting/ Lockup	Mechanical Wear	*Same as B1.1.1, Mechanical Wear Aging Mechanism*
B2.2.3	Prestress-ing System	Tendons and Anchorage Compo-nents	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion of Tendons/ Anchorage Components	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism* NUREG-1522 IN 99-10

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Mechanical Wear Aging Mechanism	*Same as B1.1.1, Mechanical Wear Aging Mechanism*	*Same as B1.1.1, Mechanical Wear Aging Mechanism*
Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism Note: 10CFR50.55a and IWL do not apply to bonded post-tensioning systems. NUREG-1611 identifies 10CFR50.55a/IWL for managing tendon and anchor corrosion.	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*	No.
NUREG-1522 and IN 99-10 describe conditions in tendon access galleries conducive to corrosion of tendon anchorage components.	Managing the condition and environment in the tendon access gallery (e.g., moisture and humidity) is a prudent way to manage the degradation (i.e., corrosion) of bearing plates and other vertical tendon anchorage components.	Yes. Plant-specific considera-tion of the tendon access gallery should be evaluated.

II CONTAINMENT STRUCTURES
B BWR Containments
B2 Mark II Containments
B2.2 Concrete Containments

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.2.3	Prestress-ing System	Tendons and Anchorage Compo-nents	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Prestress	Relaxation; Shrinkage; Creep; Elevated Temperature	10CFR50.55a ASME Section XI, Subsection IWL NUREG-1611 10CFR54 Regulatory Guide 1.35.1 IN 99-10

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWL Note: 10CFR50.55a and IWL do not apply to bonded post-tensioning systems. NUREG-1611 identifies both 10CFR50.55a/IWL and TLAA to manage loss of prestress	Previous evaluation of 10 CFR 50.55a, IWL is augmented as follows: ***(5) Monitoring and Trending:*** 10 CFR 50.55a and IWL do not provide guidance on how to calculate expected tendon prestressing forces that are needed to compare against the measured tendon lift-off forces. This guidance is provided in NRC Regulatory Guide 1.35.1.	No, Provided Regulatory Guide 1.35.1 is followed. Otherwise plant-specific evaluation is necessary.
Tendon Surveillance Program requires TLAA.	To ensure that the structural and functional adequacy of the containment are maintained, a TLAA for the tendon prestressing forces is needed for the extended period of operation. A TLAA for the containment prestressing system which meets 10CFR54.21(c)(1)(ii) should have the following basic attributes: 1. Calculation of the minimum required prestressing force value (MRV) for each tendon group. 2. Calculated predicted lower limit (PLL) prestressing force for each group of tendons (See NRC R.G. 1.35.1). During each inspection, the measured prestressing forces in the sampled tendons are compared against the PLL. As discussed in IN 99-10, the trend lines shall be developed using a regression analysis considering individual tendon lift-off forces rather than the average lift-off forces for each group of tendons. 3. The PLL developed for the 40 year period of operation shall be extended to 60 years. The applicant has to demonstrate that the trend of the measured prestressing forces during the extended period remain above the PLL for each tendon group. If this can not be achieved, then a systematic plan of retensioning selected tendons should be developed which would result in the trend lines remaining above the PLL or a reanalysis of the containment demonstrating design adequacy is needed. If the approach described above is not feasible due to the lack of available tendon lift-off force data needed to develop trend lines, then a TLAA for containment prestressing forces performed in accordance with 10 CFR 54.21(c)(1)(iii) is acceptable. In this case, the TLAA must satisfy the ten (10) criteria for an acceptable aging management program and must specifically include the following: ***(3)Parameters Monitored:*** The parameters to be monitored are the prestressing forces in accordance with requirements specified in Subsection IWL of Section XI of the ASME Code as incorporated by reference in 10 CFR 50.55a. ***(5) Monitoring and Trending:*** The prestressing forces shall be plotted against time and trending lines developed for the period of extended operation. ***(6) Acceptance Criteria:*** The prestressing force trend lines must be shown to be above the prescribed lower limit (PLL) lines.	Yes. Methodology for TLAA must be evaluated.

II CONTAINMENT STRUCTURES

B BWR Containments

B2 Mark II Containments

B2.2 Concrete Containments

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(7) Corrective Actions: If the trend lines cross the PLL at any time, then either retensioning of some tendons or a reanalysis of the containment will be needed. ***(10) Operating Experience:*** The program shall incorporate any operating experience that occurs at the plant requesting license renewal as well as other plants. Problems with the prestressing system described in NRC IN 99-10 (with the exception of temperature effects due to sun exposure) should also be incorporated into the TLAA.	

B3. Mark III Containments

B3.1 Steel Containments
- B3.1.1 Steel Elements
- B3.1.2 Concrete Elements

B3.2 Concrete Containments
- B3.2.1 Concrete Elements
- B3.2.2 Steel Elements

B3. Mark III Containments

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, Mark III containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively. This format follows the presentation format in Section 3.4 of the draft Standard Review Plan for License Renewal (SRP-LR). In Review Table II B3, Mark III Concrete containments are divided into three elements: concrete, steel, and prestressing system and Mark III Steel containments are divided into two elements: steel and concrete.

System Interfaces

Functional interfaces include the primary containment HVAC system(VII.I), containment isolation system(V.A), containment spray system(V.B), and containment heat removal system(V.C). Physical interfaces exist with any structure, system, or component which either penetrates the containment wall, such as the main steam system(VIII.A) and feedwater systems(VIII.F,VIII.G), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

II CONTAINMENT STRUCTURES
B BWR Containments
B3 Mark III Containments
B3.1 Steel Containments

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.1.1	Steel Elements	Contain-ment Shell; Suppres-sion Chamber Shell; Basemat Liner; Liner Anchors; Embedded Shell Region	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as B1.1.1, Corrosion Aging Mechanism*
B3.1.1	Steel Elements	Suppres-sion Chamber Shell (Interior Surface)	Stainless Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Corrosion Aging Mechanism	*Same as B1.1.1, Corrosion Aging Mechanism*	*Same as B1.1.1, Corrosion Aging Mechanism*
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by Examination Category E-P (10 CFR 50, Appendix J, Integrated Leak Rate Test).	No.

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.1.2	Concrete Elements	Basemat; Concrete Fill in Annulus	Concrete	Inside and/or Outside Contain-ment	Increase in Porosity, Permea-bility; Scaling, Cracking, Spalling	Leaching of Calcium Hydroxide; Aggressive Chemical Attack	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*
B3.1.2	Concrete Elements	Basemat; Concrete Fill in Annulus	Concrete	Inside and/or Outside Contain-ment	Expansion & Cracking	Reaction with Aggregates	*Same as B1.2.1, Reaction with Aggregates Aging Mechanism*
B3.1.2	Concrete Elements	Basemat and Reinforcing Steel	Concrete; Carbon Steel	Inside and/or Outside Contain-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*
Same as B1.2.1, Reaction with Aggregates Aging Mechanism	*Same as B1.2.1, Reaction with Aggregates Aging Mechanism*	No
Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.1.2	Concrete Elements	Basemat	Concrete	Inside and/or Outside Contain-ment	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as B2.2.1, Settlement Aging Mechanism*
B3.1.2	Concrete Elements	Basemat; Concrete Fill in Annulus	Concrete	Inside and/or Outside Contain-ment	Loss of Strength and Modulus	Elevated Tempera-ture	*Same as B1.2.1, Elevated Temperature Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B2.2.1, Settlement Aging Mechanism	*Same as B2.2.1, Settlement Aging Mechanism*	*Same as B2.2.1, Settlement Aging Mechanism*
Same as B1.2.1, Elevated Temperature Aging Mechanism	*Same as B1.2.1, Elevated Temperature Aging Mechanism*	*Same as B1.2.1, Elevated Temperature Aging Mechanism*

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Inside and/or Outside Contain-ment	Scaling, Cracking, Spalling	Freeze/ Thaw	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Inside and/or Outside Contain-ment	Increase in Porosity, Permea-bility; Scaling, Cracking, Spalling	Leaching of Calcium Hydroxide; Aggressive Chemical Attack	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*	No
Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*	*Same as B1.2.1, Aggressive Chemical Attack Aging Mechanism*

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Inside and/or Outside Contain-ment	Expansion & Cracking	Reaction with Aggregates	*Same as B1.2.1, Reaction with Aggregates Aging Mechanism*
B3.2.1	Concrete Elements	Dome, Wall, Basemat, Reinforcing Steel	Concrete; Carbon Steel	Inside and/or Outside Contain-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.2.1, Reaction with Aggregates Aging Mechanism	*Same as B1.2.1, Reaction with Aggregates Aging Mechanism*	No
Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as B1.2.1, Corrosion of Embedded Steel Aging Mechanism*

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.2.1	Concrete Elements	Basemat	Concrete	Inside and/or Outside Contain-ment	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as B2.2.1, Settlement Aging Mechanism*
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Inside and/or Outside Contain-ment	Loss of Strength and Modulus	Elevated Tempera-ture	*Same as B1.2.1, Elevated Temperature Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B2.2.1, Settlement Aging Mechanism	*Same as B2.2.1, Settlement Aging Mechanism*	*Same as B2.2.1, Settlement Aging Mechanism*
Same as B1.2.1, Elevated Temperature Aging Mechanism	*Same as B1.2.1, Elevated Temperature Aging Mechanism*	*Same as B1.2.1, Elevated Tempera-ture Aging Mechanism*

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.2.2	Steel Elements	Contain-ment Liner, Suppres-sion Chamber Liner, Basemat Liner, Liner Anchors	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as B1.1.1, Corrosion Aging Mechanism*
B3.2.2	Steel Elements	Suppres-sion Chamber Liner (Interior Surface)	Stainless Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as B2.2.2, Stress Corrosion Cracking Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Corrosion Aging Mechanism	*Same as B1.1.1, Corrosion Aging Mechanism*	*Same as B1.1.1, Corrosion Aging Mechanism*
Same as B2.2.2, Stress Corrosion Cracking Aging Mechanism	*Same as B2.2.2, Stress Corrosion Cracking Aging Mechanism*	*Same as B2.2.2, Stress Corrosion Cracking Aging Mechanism*

B4. Common Components

B4.1 Penetration Sleeves, Penetration Bellows, Dissimilar Metal Welds
B4.2 Personnel Airlock, Equipment Hatch, CRD Hatch
B4.3 Subfoundation Layer
B4.4 Seals and Gaskets

B4. Common Components

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, Mark III containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively. This format follows the presentation format in Section 3.4 of the draft Standard Review Plan for License Renewal (SRP-LR). Common components in Review Table II B4 include penetation sleeves and bellows; dissimilar metal welds; personnel airlock; equipment hatch; CRD hatch; subfoundation layer; and seals/gaskets.

System Interfaces

Functional interfaces include the primary containment HVAC system(VII.I), containment isolation system(V.A), containment spray system(V.B), and containment heat removal system(V.C). Physical interfaces exist with any structure, system, or component which either penetrates the containment wall, such as the main steam system(VIII.A) and feedwater systems(VIII.F,VIII.G), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B4.1	---	Penetration Sleeves; Penetration Bellows; Dissimilar Metal Welds	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as B1.1.1, Corrosion Aging Mechanism*
B4.1	---	Penetration Sleeves; Penetration Bellows; Dissimilar Metal Welds	Carbon Steel and Stainless Steel	Inside and/or Outside Contain-ment	Cumula-tive Fatigue Damage	Cyclic Loading	*Same as B1.1.1, Cycling Loading Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Corrosion Aging Mechanism	*Same as B1.1.1, Corrosion Aging Mechanism*	*Same as B1.1.1, Corrosion Aging Mechanism*
Same as B1.1.1, Cycling Loading Aging Mechanism	*Same as B1.1.1, Cycling Loading Aging Mechanism*	*Same as B1.1.1, Cycling Loading Aging Mechanism*

II CONTAINMENT STRUCTURES
B BWR Containments
B4 Common Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B4.1	---	Penetration Sleeves; Penetration Bellows; Dissimilar Metal Welds	Carbon Steel and Stainless Steel	Inside and/or Outside Contain-ment	Crack Initiation and Growth	Stress Corrosion Cracking	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*
B4.2	---	Personnel Airlock; Equipment Hatch; CRD Hatch	Carbon Steel	Inside and/or Outside Contain-ment	Loss of Material	Corrosion	*Same as B1.1.1, Corrosion Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*	*Same as B1.1.1, Stress Corrosion Cracking Aging Mechanism*
Same as B1.1.1, Corrosion Aging Mechanism	*Same as B1.1.1, Corrosion Aging Mechanism*	*Same as B1.1.1, Corrosion Aging Mechanism*

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B4.2	---	Personnel Airlock; Equipment Hatch; CRD Hatch	Carbon Steel	Inside and/or Outside Contain-ment	Fretting/ Lockup	Mechanical Wear of Locks/ Hinges and Closure Mechanisms	*Same as B1.1.1, Mechanical Wear Aging Mechanism*
B4.3	---	Subfounda-tion Layer	Porous Concrete	Under-ground	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	NUREG-1611 NRC IN 97-11 NRC IN 98-26

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as B1.1.1, Mechanical Wear Aging Mechanism	*Same as B1.1.1, Mechanical Wear Aging Mechanism*	*Same as B1.1.1, Mechanical Wear Aging Mechanism*
No specific Aging Management Program exists. NUREG-1611 identifies erosion of porous concrete subfoundation as a potential aging mechanism.	Erosion of cement from porous concrete subfoundations beneath containment basemats is described in IN 97-11. IN 98-26 identifies Maintenance Rule Structures Monitoring for managing this aging effect, if applicable. (See Chapter III.A, Class 1 Structures for evaluation of Maintenance Rule Structures Monitoring)	Yes. If applicable, plant-specific evaluation is required.

II CONTAINMENT STRUCTURES
B BWR Containments
B4 Common Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B4.4	---	Seals & Gaskets	Various	Inside and/or Outside Contain-ment	Loss of Sealing	Deteriora-tion of Joint Sealants, Gaskets, O-rings	10CFR50.55a ASME Section XI, Subsection IWE 10CFR50, Appendix J

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Codes and Standards (10CFR50.55a), ASME Section XI, Subsection IWE	Aging effect will be managed by IWE. Leak tightness will be monitored by Appendix J Leak Rate Tests.	No.

References

American Concrete Institute, ACI 201.1R-68, "Guide for Making a Condition Survey of Concrete in Service," Revised 1984.

American Concrete Institute, ACI 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," March 1996.

American National Standard Institute, ANSI/ANS 56.8-1994, "Containment System Leakage Testing Requirements."

American Society of Mechanical Engineers, ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components,* Subsection IWE, *Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Power Plants,* 1992 Edition with 1992 Addenda. The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.

American Society of Mechanical Engineers, ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components,* Subsection IWL, *Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants,* 1992 Edition with 1992 Addenda. The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.

American Society for Testing and Materials, ASTM D5163-96, "Standard Guide for Establishing Procedures to Monitor the Performance of Safety Related Coatings in an Operating Nuclear Power Plant."

Code of Federal Regulations: 10CFR50, Appendix J, "Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors."

Code of Federal Regulations: 10CFR50.55a, "Codes and Standards."

Code of Federal Regulations: 10CFR50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors."

Code of Federal Regulations: 10CFR50.73, "Licensee Event Report System."

Code of Federal Regulations: 10CFR54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

NRC Generic Letter 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-Of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," July 14, 1998.

NRC Information Notice 92-20, "Inadequate Local Leak Rate Testing," March 3, 1992.

NRC Information Notice 97-10, "Liner Plate Corrosion in Concrete Containment," March 13, 1997.

NRC Information Notice 97-11, "Cement Erosion from Containment Subfoundations at Nuclear Power Plants," March 21, 1997.

NRC Information Notice 98-26, "Settlement Monitoring and Inspection of Plant Structures Affected by Degradation of Porous Concrete Subfoundations," July 24, 1998.

NRC Information Notice 99-10, "Degradation of Prestressing Tendon Systems in Prestressed

Concrete Containments," April 13, 1999.

NRC Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," July 1990.

NRC Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program," September 1995.

NRC Draft Regulatory Guide DG-1076, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," February 1999.

NUREG-1522, "Assessment of Inservice Conditions of Safety-Related Nuclear Power Plant Structures," June 1995.

NUREG-1611, "Aging Management of Nuclear Power Plant Containments for License Renewal," September 1997.

Nuclear Energy Institute, NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10CFR Part 50, Appendix J," Revision 0, July 26, 1995.

CHAPTER III

STRUCTURES
AND
COMPONENT SUPPORTS

Major Plant Structures and Components

Chapter III A: Major Plant Structures

Chapter III B: Major Component Supports

CHAPTER III A

CLASS 1 STRUCTURES

Major Class 1 Structures

A1. Group 1 Structures (BWR Reactor Bldg, PWR Shield Bldg, Control Rm/Bldg)

A2. Group 2 Structures (BWR Reactor Bldg with Steel Superstructure)

A3. Group 3 Structures (Auxiliary Bldg, Diesel Generator Bldg, Radwaste Bldg, Turbine Bldg, Switchgear Rm, AFW Pumphouse, Utility/Piping Tunnels)

A4. Group 4 Structures (Containment Interior Structures, excluding Refueling Canal)

A5. Group 5 Structures (Fuel Storage Facility, Refueling Canal)

A6. Group 6 Structures (Water-Control Structures)

A7. Group 7 Structures (Concrete Tanks)

A8. Group 8 Structures (Steel Tanks)

A9. Group 9 Structures (BWR Unit Vent Stack)

A1. Group 1 Structures (BWR Reactor Bldg, PWR Shield Bldg, Control Rm/Bldg)

A1.1 Concrete Elements
A1.2 Steel Elements
A1.3 Masonry Walls

A1. Group 1 Structures (BWR Reactor Bldg, PWR Shield Bldg, Control Rm/Bldg)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A1 addresses the elements of BWR Reactor Building, PWR Shield Building, and Control Room Building. For this group, the applicable structural elements are identified: concrete, steel, and masonry walls. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking, Spalling	Freeze/ Thaw	10CFR50.65 NUMARC 93-01, Revision 2 Regulatory Guide 1.160, Revision 2

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule (10CFR50.65) -Structures monitoring The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structure monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License	An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures and component supports will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for an acceptable aging management program follows: **(1)Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect/aging mechanism combinations which are managed by the MR Structures Monitoring Program. For potential structure/aging effect/aging mechanism combinations not covered by the MR Structures Monitoring Program, the applicant should justify that it is not significant for the applicant's plant, or identify the applicable aging management program. **(2) Preventive Actions:** Inspection and maintenance of protective coatings which inhibit corrosion of steel structural elements should be included as part of Structures Monitoring. No specific preventive actions are identified for other aging mechanisms. **(3) Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters monitored or inspected is the responsibility of the licensee. For License Renewal, the specific parameters monitored or inspected should be linked to degradation of intended function(s) and should detect the presence and extent of aging effects. The inspection scope should include bolt-tightness checks for concrete expansion anchors subjected to vibratory loads. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. **(4) Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the inspection schedule, inspection methods and inspector qualifications are defined by the individual licensees. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4.	No, if the structure/ aging effect /aging mechanism combina-tion is within the scope of the applicant's MR Structures Monitoring Program or if it is not applicable. Otherwise, justification for identifying the aging effect /aging mechanism as "non-significant" or details of plant-specific program need to be evaluated.

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Subsystem	Component	Material	Environ-ment	Aging Effect	Aging Mechanism	References
							NUREG-1557 ASTM C33-90 ACI 318-63 ACI 349-85

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Renewal applicants are encouraged to take credit for existing programs. A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal. The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structures monitoring under the Maintenance Rule. Plant-specific structures monitoring programs are identified and described, to demonstrate that adequate aging management programs are in place for structures and structural components. These programs were evaluated by the staff against the ten (10) criteria for an acceptable aging management program, defined in Section 3.0 of the Draft SRP-LR. For the most part, these programs are considered adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria.. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal.	**(5) Monitoring and Trending:** Documentation and comparison of successive inspection results is needed to perform meaningful trending. An appropriate inspection schedule should be established to provide reasonable assurance that adequate monitoring and trending will be accomplished under the MR Structure Monitoring Program. **(6) Acceptance Criteria:** Acceptance criteria, against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. These criteria are defined on a licensee-specific basis. The acceptance criteria should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the acceptance criteria utilized in its MR Structures Monitoring Program will provide for timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. **(7) Corrective Actions:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Corrective Action requirement of Criterion 7 is satisfied. **(8) Confirmation Process:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Confirmation requirement of Criterion 8 is satisfied. **(9) Administrative Controls:** Provided the MR Structures Monitoring Program is conducted under 10CFR50 Appendix B (Quality Assurance), the Administrative Controls requirement of Criterion 9 is satisfied. **(10) Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation which threatens intended functions have only recently been implemented. At this time, it appears that MR Structures Monitoring should be an effective program, provided the details of licensee-specific programs adequately address Criteria 1, 3, 4, and 6.	
Basis for non-significance	Per NUREG-1557, freeze/thaw is non-significant if located in a geographic region of negligible weathering conditions (weathering index <100 day-inch/yr); and if located in severe weathering conditions (weathering index >500 day-inch/yr) or moderate weathering conditions (100-500 day-inch/yr), the concrete mix design meets the air content (entrained air 3-6%) and water-to-cement ratio (0.35-0.45) requirements of ACI 318-63 or ACI 349-85. The weathering index is defined in ASTM C33-90, Table 3, Footnote E. Fig. 1 of ASTM C33-90 illustrates the various weathering index regions throughout the U.S..	

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 201.2R-67
A1.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ASTM C295-54 ASTM C227-50 ACI 201.2R-67
A1.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 318-63 ACI 349-85
A1.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, leaching of calcium hydrides is non-significant if not exposed to flowing water or if exposed to flowing water, constructed using the guidance of ACI 201.2R-67 to ensure dense, well-cured concrete with low permeability and control cracking through proper arrangement and distribution of reinforcement.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, reaction with aggregates is non-significant if the aggregates were investigated, tested, and subjected to petrographic examinations in accordance with ASTM C295-54 or ASTM C227-50 that showed the aggregates are non-reactive; or if the aggregates were potentially reactive, the provisions of ACI 201.2R-67 were followed.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, corrosion of embedded steel is non-significant for exterior above grade and interior if not exposed to aggressive environment (pH <11.5 or chlorides >500 ppm); or if exposed to aggressive environment, the concrete has low water-to-cement ratio (0.35-0.45), adequate air entrainment (3-6%), low permeability, and designed in accordance with ACI 318-63 or ACI 349-85. Per NUREG-1557, for components exposed to groundwater such as foundations and exterior concrete below grade, evaluate on a case-by-case basis to ensure the aging effects of corrosion of embedded steel on concrete surfaces will be managed to maintain intended functions during the period of extended operation.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism Basis for non-significance	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, aggressive chemical attack is non-significant for exterior above grade and interior if not exposed to aggressive environment (pH <5.5), or to chloride or sulfate solutions beyond defined limits (>500 ppm chloride, or >1500 ppm sulfate); or if exposed to aggressive environment that exceeds the pH, chloride, or sulfate limits the exposure is for intermittent periods only. Applicant must define "intermittent periods" if it is the technical basis for non-significance. Per NUREG-1557, exterior below grade and foundation should be evaluated on a case-by-case basis to ensure that the aging effects of aggressive chemical attack on below-grade concrete surfaces will be managed to maintain the intended function(s) of Class I structure components during the period of extended operation.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557 ACI 318-63 ACI 349-85
A1.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* IN 97-11 IN 98-26
A1.2	Steel Compo-nents	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* NUREG-1557

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Consideration of settlement is required by ACI 318-63 or ACI 349-85. For sites with soft soil or changes in the groundwater table, a settlement monitoring program is needed. Applicant should justify non-significance or identify program credited for monitoring settlement.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* IN 98-26 identifies MR Structures Monitoring for managing this aging effect, if applicable.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Per NUREG-1557, inspection and maintenance of protective coatings are effective preventive measures for accessible areas. Inaccessible areas should be evaluated on a case-by-case basis to ensure that aging effects of corrosion will be managed.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A1.3	Masonry Walls	All	Concrete Block	Ambient Environ-ment Inside Building	Cracking	Restraint; Shrinkage; Creep; Aggressive Environ-ment	IE Bulletin 80-11 IN 87-67

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
IE Bulletin 80-11 **IN No. 87-67:** The IE Bulletin No.80-11 titled "Masonry Wall Design" was issued to address the concern with regard to the adequacy of the design criteria used in the design of masonry walls and the apparent lack of design criteria coordination between the structural and piping/equipment design groups. It required all operating nuclear power plants to address this issue by 1) identifying all masonry walls in close proximity or having attachments from safety-related piping or equipment, and 2) performing reevaluation of design adequacy of the walls and the construction practices employed in the construction of these walls. The NRC Information Notice (IN) No. 87-67 titled "Lessons Learned from Regional Inspection of Licensee Actions in Response to IE Bulletin 80-11"documented the inspection experience conducted by the NRC staff with respect to plant-specific implementation and corrective actions in executing the IE Bulletin 80-11 requirements. During the inspections performed at several plants, a number of deficiencies having the potential for affecting plant safety were identified. In each case of the identified deficiencies, remedial action was required by the licensee. The IN No. 87-67 concluded that the recurring nature of some of the observed cracks may justify the need for a periodic surveillance program to ensure that the level of structural adequacy to which licensees committed is maintained. Applicant should develop a program with procedural controls requiring engineering notification, reevaluation, and periodic inspections to ensure that the structural integrity of these walls is maintained. IN No. 87-67 states that these programs ensure that the physical condition of the walls, such as lack of mortar cracking and boundary conditions, remain as analyzed. Therefore, a periodic inspection and surveillance program instituted by the licensee in accordance with the insights provided in IN No. 87-67, constitutes part of a aging management program for masonry walls that were covered by IE Bulletin 80-11. Such program, if properly managed, should provide reasonable assurance that any recurrence of aged-related deficiencies (e.g. mortar cracks) that could potentially compromise masonry wall's intended	***(1) Scope of Program:*** The IE Bulletin 80-11 and IN No. 87-67 apply to all masonry walls which are in proximity to or having attachments from safety-related piping or equipment such that wall failure could affect a safety-related system. However, during the implementation of USI A-46, numerous instances of masonry walls which are important to safety but not covered by the IE Bulletin 80-11 were identified, due to either reclassification of non-safety-related system to safety-related, or falling of non-safety-related system onto safety-related systems. In these cases, if the verification can be established that the masonry walls were evaluated and maintained in accordance with the requirements of the IE Bulletin 80-11 and the insights provided by the IN No. 87-67, the subject walls should be treated as within the scope encompassed by the IE Bulletin 80-11 and IN No. 87-67. ***(2) Preventive Actions:*** The IN No. 87-67 called for a periodic surveillance program by the licensee to monitor any specific conditions (e.g. mortar cracks) of masonry walls to ascertain that the level of structural adequacy to which licensees committed is maintained. It also suggested that the licensee's periodic surveillance program for managing the effects of cracking in masonry walls should include: 1) an analysis of the probable cause of the cracks; 2) documentation of the repair efforts for these cracks or a demonstration of the structural adequacy of the walls, including the effects of the cracked block and mortar; and 3) a description of the measures to be taken to prevent recurrence of similar cracking in these and other safety-related masonry walls that are not reinforced. However, no specific interval for the periodic inspection was suggested by the IN No. 87-67. 10 CFR 50.65(a) Paragraph 3 requires that the effectiveness of maintenance programs be assessed at least every two years. ***(3) Parameters Monitored/Inspected:*** The IN No. 87-67 identified cracks in masonry walls, especially unreinforced walls, as being the primary age-related degradation mechanisms for masonry wall structures as encompassed in Scope, and discussed the extent to which the age-related degradation mechanisms impact the intended functions of the safety-related piping or equipment being supported by the walls, if the effects of aging-related degradation of masonry walls are left undetected, uncorrected and unmanaged. ***(4) Detection:*** If properly conducted, inspection programs following the IE Bulletin 80-11 and IN No. 87-67 should provide reasonable assurance that any recurrence of aged-related deficiencies (e.g. mortar cracks) that could potentially compromise a masonry wall's intended functions will be identified. ***(5) Monitoring and Trending:*** The IN No. 87-67 suggested periodic surveillance to monitor any specific conditions (e.g. mortar cracks) of masonry walls to ascertain that the level of structural adequacy to which licensees committed is maintained, and abnormalities affecting facility safety identified by the surveillance program should be met with corresponding corrective action. The periodic inspections should also provide predictability of the extent of age-related degradation.	No. Acceptable for managing aging effect.

III STRUCTURES AND COMPONENT SUPPORTS

A1. Group 1 Structures (BWR reactor building, PWR shield building, Control room/building)

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
functions will be identified and corrected in a timely manner, so that the structural adequacy of these walls will be maintained.	***(6) Acceptance Criteria:*** The IE Bulletin 80-11, Section 2.b.(iii) provides the acceptance criteria for the re-evaluation of masonry walls. The licensee can use existing test data to justify alternate re-evaluation acceptance criteria, provided the criteria are shown to be conservative and applicable for the actual plant conditions. As an alternate, the IE Bulletin 80-11, Section 3 specifies that a confirmatory masonry wall test program can be conducted; the test program should address all appropriate loading conditions (seismic, tornado, missile, etc.). ***(7) Corrective Actions:*** As described in Preventive actions, the inspection report includes provisions for technical assessment of the causes of abnormal conditions and recommendations for remedial or mitigating measures. Therefore, issues related to corrective actions, including root cause determination and prevention of recurrence are adequately addressed. ***(8) Confirmation Process:*** Although the IN No. 87-67 did not require written response from licensees, the commission's regulations, as summarized in Regulatory Guide 1.16, "Reporting of Operating Information – Appendix A Technical Specifications" does require that any abnormal hazardous conditions observed during the inspection should be reported to the NRC staff. The age-related degradation mechanisms associated with masonry walls as identified in the IN No. 87-67 should provide guidance for determining abnormal hazardous conditions for masonry walls. ***(9) Administrative Controls:*** The IN No. 87-67 identified that lack of procedural control in some facilities contributed to compromising the structural qualification bases developed in the IE Bulletin 80-11 program, and concluded that inspection programs with procedural controls, requiring engineering notification of plant modifications, re-evaluation, and periodic inspections to ensure that the structural integrity of these walls is maintained, should provide adequate assurance that current plant conditions are used in the structural qualification of masonry walls. ***(10) Operating Experience:*** Although the IE Bulletin 80-11 implementation was measured as being a reasonably successful program, there were instances where masonry walls not included in the IE Bulletin 80-11 program were later identified to be important to safety in the USI A-46 program. This problem occurred largely because of reclassification of non-safety-related systems to safety-related systems and identification of certain non-safety-related systems whose failure could prevent the successful accomplishment of intended functions of safety-related systems. Lessons learned from A-46 program should be incorporated into the licensee's inspection program to assure that the structural integrity of all masonry walls important to safety are adequately managed for the extended period of operation.	

A2. Group 2 Structures (BWR Reactor Bldg with Steel Superstructure)

A2.1 Concrete Elements
A2.2 Steel Elements
A2.3 Masonry Walls

A2. Group 2 Structures (BWR Reactor Bldg with Steel Superstructure)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A2 addresses the elements of BWR Reactor Building with Steel Superstructure. For this group, the applicable structural elements are identified: concrete, steel, and masonry walls. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A2. Group 2 Structures (BWR reactor building with steel superstructure)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A2.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking Spalling	Freeze/ Thaw	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
A2.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
A2.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A2.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
A2.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

A2. Group 2 Structures (BWR reactor building with steel superstructure)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/Thaw Aging Mechanism	*Same as A1.1, Freeze/*Thaw Aging Mechanism	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
Same as A1.1, Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A2. Group 2 Structures (BWR reactor building with steel superstructure)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A2.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as A1.1, Settlement Aging Mechanism*
A2.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
A2.2	Steel Compo-nents	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A2.3	Masonry Walls	All	Concrete Block	Ambient Environ-ment Inside Building	Cracking	Restraint; Shrinkage; Creep; Aggressive Environ-ment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

A2. Group 2 Structures (BWR reactor building with steel superstructure)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Settlement Aging Mechanism	*Same as A1.1, Settlement Aging Mechanism*	*Same as A1.1, Settlement Aging Mechanism*
Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism* Note: Per NUREG-1557, aging management of the metal siding and roofing for loss of material due to corrosion is an unresolved issue.	*Same as A1.2, Corrosion Aging Mechanism*
Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

A3. Group 3 Structures (Auxiliary Bldg, Diesel Generator Bldg, Radwaste Bldg, Turbine Bldg, Switchgear Rm, AFW Pumphouse,Utility/Piping Tunnels)

A3.1 Concrete Elements
A3.2 Steel Elements
A3.3 Masonry Walls

A3. Group 3 Structures (Auxiliary Bldg, Diesel Generator Bldg, Radwaste Bldg, Turbine Bldg, Switchgear Rm, AFW Pumphouse,Utility/Piping Tunnels)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A3 addresses the elements of Auxiliary Building, Diesel Generator Building, Radwaste Building, Turbine Building, Switchgear Room, AFW Pumphouse, and Utility/Piping Tunnels. For this group, the applicable structural elements are identified: concrete, steel, and masonry walls. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A3. Group 3 Structures (Aux., diesel generator, radwaste, turbine buildings; and switchgear room, aux. feedwater pump house, utility/piping tunnels)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking Spalling	Freeze/ Thaw	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
A3.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
A3.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A3.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
A3.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

A3. Group 3 Structures (Aux., diesel generator, radwaste, turbine buildings; and switchgear room, aux. feedwater pump house, utility/piping tunnels)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/Thaw Aging Mechanism	*Same as A1.1, Freeze/Thaw Aging Mechanism*	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
Same as A1.1, Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A3. Group 3 Structures (Aux., diesel generator, radwaste, turbine buildings; and switchgear room, aux. feedwater pump house, utility/piping tunnels)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A3.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as A1.1, Settlement Aging Mechanism*
A3.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
A3.2	Steel Compo-nents	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A3.3	Masonry Walls	All	Concrete Block	Ambient Environ-ment Inside Building	Cracking	Restraint; Shrinkage; Creep; Aggressive Environ-ment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

A3. Group 3 Structures (Aux., diesel generator, radwaste, turbine buildings; and switchgear room, aux. feedwater pump house, utility/piping tunnels)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Settlement Aging Mechanism	*Same as A1.1, Settlement Aging Mechanism*	*Same as A1.1, Settlement Aging Mechanism*
Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism*	*Same as A1.2, Corrosion Aging Mechanism*
Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

A4. Group 4 Structures (Containment Interior Structures, excluding Refueling Canal)

A4.1 Concrete Elements
A4.2 Prestressing Elements
A4.3 Steel Elements

A4. Group 4 Structures (Containment Interior Structures, excluding Refueling Canal)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A4 addresses the elements of Containment Interior Structures, excluding Refueling canal. For this group, the applicable structural elements are identified: concrete, steel, and prestressing system. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A4. Group 4 Structures (Containment internal structures, excluding refueling canal)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A4.1	Concrete	All	Reinforced Concrete	Inside Contain-ment, Exposure to Aggressive Environ-ment	Increase in Porosity and Permea-bility, Cracking, Spalling	Aggressive Chemical Attack	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*
A4.1	Concrete	All	Reinforced Concrete	Inside Contain-ment	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A4.1	Concrete	All	Reinforced Concrete	Inside Contain-ment, Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
A4.2	Steel Compo-nents	All	Carbon Steel and Stainless Steel	Inside Contain-ment	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A4.3	Prestress-ing System	Tendons and Anchors	Steel	Inside Contain-ment	Loss of Material	Corrosion	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism*
A4.3	Prestress-ing System	Tendons	Steel	Inside Contain-ment	Loss of Prestress	Tendon Relaxation; Concrete Creep and Shrinkage	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism*

A4. Group 4 Structures (Containment internal structures, excluding refueling canal)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism*	*Same as A1.2, Corrosion Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Where applicable, loss of material due to corrosion must be managed to maintain the prestressing system's intended functions during the period of extended operation.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Where applicable, loss of prestress due to tendon relaxation, concrete creep and shrinkage must be managed to maintain the prestressing system's intended functions during the period of extended operation.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*

A5. Group 5 Structures (Fuel Storage Facility, Refueling Canal)

A5.1 Concrete Elements
A5.2 Steel Elements
A5.3 Masonry Walls

A5. Group 5 Structures (Fuel Storage Facility, Refueling Canal)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A5 addresses the elements of Fuel Storage Facility and Refueling Canal. For this group, the applicable structural elements are identified: concrete, steel, and masonry walls The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A5. Group 5 Structures (Fuel storage facility, refueling canal)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A5.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking Spalling	Freeze/ Thaw	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
A5.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
A5.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A5.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
A5.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

A5. Group 5 Structures (Fuel storage facility, refueling canal)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/*Thaw Aging Mechanism*	Same as A1.1, Freeze/*Thaw Aging Mechanism*	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
Same as A1.1, Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A5. Group 5 Structures (Fuel storage facility, refueling canal)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A5.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as A1.1, Settlement Aging Mechanism*
A5.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
A5.2	Steel Compo-nents	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A5.2	Steel Compo-nents	Liners	Stainless Steel	Exposed to Water	Crack Initiation and Growth, Loss of Material	Stress Corrosion Cracking and Crevice Corrosion	NUREG-1557
A5.3	Masonry Walls	Fuel Storage Facility	Concrete Block	Ambient Environ-ment Inside Building	Cracking	Restraint; Shrinkage; Creep; Aggressive Environ-ment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

A5. Group 5 Structures (Fuel storage facility, refueling canal)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Settlement Aging Mechanism	*Same as A1.1, Settlement Aging Mechanism*	*Same as A1.1, Settlement Aging Mechanism*
Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism*	*Same as A1.2, Corrosion Aging Mechanism*
Periodic monitoring of the leak chase system drain lines and the leak detection sump for early detection and repair of leaks in liners.	Current leakage detection and inventory monitoring systems provide timely means to identify, monitor, and repair liner degradation.	No. Acceptable method for managing aging effect.
Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

A6. Group 6 Structures (Water-Control Structures)

A6.1 Concrete Elements
A6.2 Steel Elements
A6.3 Masonry Walls

A6. Group 6 Structures (Water-Control Structures)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A6 addresses the elements of Water-Control Structures. For this group, the applicable structural elements are identified: concrete, steel, and masonry walls. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A6. Group 6 Structures (Water-control structures)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A6.1	Concrete	Exterior Above and Below Grade; Foundation; Interior Slab	Reinforced Concrete	Weather Exposed	Scaling, Cracking, Spalling	Freeze/ Thaw	Regulatory Guide 1.127 NUREG-1557

A6. Group 6 Structures (Water-control structures)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
REGULATORY GUIDE 1.127 The USNRC Regulatory Guide 1.127 titled "Inspection of Water-Control Structures Associated with Nuclear Power Plants" describes a basis acceptable to the NRC staff for developing an appropriate in-service inspection and surveillance program for dams, slopes, canals and other water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants. The need for the in-service inspection and surveillance program is discussed in the context of historic data related to age-related deterioration and degradation due to extreme environmental conditions and the effects of natural phenomena which impacted on Water-Control Structures and the importance for periodically monitoring the performance and maintenance so that the consequences of these age-related deterioration and degradation failures could be timely prevented and mitigated. The Guide provides detailed inspection guidance and acceptance criteria for the licensee's maintenance program for Water-Control Structures, including engineering data compilation, on-site inspection program, technical evaluation, inspection frequency and inspection report. Water-Control Structures, included in the Guide but not limited to, consist of a) concrete structures, b) embankment structures, c)spillway structures and outlet works, d) reservoirs, e) cooling water channels and canal and intake and discharge structures, f)safety and performance instrumentation. The positions and requirements delineated in this guide reflect current NRC staff practice in evaluating in-service inspection programs of Water-Control Structures. Per NUREG-1557, this program is acceptable for license renewal. Note: Freeze/Thaw may be non-significant. See A1.1 for technical basis	***(1) Scope of Program:*** The Guide applies to water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants. The water-control structures, included in the Guide but not limited to, consist of a) concrete structures, b) embankment structures, c) spillway structures and outlet works, d) reservoirs, e) cooling water channels and canal and intake and discharge structures, f)safety and performance instrumentation. ***(2)Preventive Actions:*** The Guide requires that the licensee's in-service inspection and surveillance program include periodic inspections of water-control structures to identify deviations in structural conditions due to age-related deterioration and degradation from the original design basis, provide inspection report including remedial and mitigating measures, where appropriate. The Guide also states that it is important that abnormalities affecting facility safety be met with quick corrective action. ***(3) Parameters Monitored/Inspected:*** The Guide identifies age-related deterioration and degradation mechanisms for water-control structures as listed in Scope, and discusses the extent to which the age-related deterioration and degradation mechanisms impact the intended functions of the water-control structures, if they were left undetected, uncorrected and unmanaged. ***(4) Detection:*** The Guide requires periodic inspections at intervals of no more than 5 years. The inspection interval increases from initial inspection, after the completion of construction. Special inspections immediately following the occurrence of significant natural phenomena events are required. A technical report should be prepared to present the results of each inspection, with conclusions and recommendations for additional investigations, remedial and mitigating measures, where appropriate, and abnormalities affecting facility safety be met with quick corrective action. ***(5) Monitoring and Trending:*** The Guide utilizes periodic monitoring performance and maintenance coupled with remedial and mitigating measures and quick corrective action when abnormalities affecting facility safety are identified. Inspection intervals should provide predictability of the extent of degradation and timely corrective or mitigative actions. ***(6) Acceptance Criteria:*** The Guide requires that the inspection report should include the following major elements: a. Initial report: 1. Results of the visual inspection of each project feature, 2. Results of the instrumentation observations, 3. Evaluation of operational adequacy of the reservoir regulation plan, maintenance of the dam, and maintenance of operating facilities, including the warning system, 4. Technical assessment of the causes of distress or abnormal conditions and evaluation of the behavior, movement, deformation, or loading of the structure,	No. Acceptable method for managing aging effect.

A6. Group 6 Structures (Water-control structures)

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	5. Conclusion and recommendations for additional investigations, remedial measures, or future inspections, where appropriate; b. Subsequent reports: These reports should include information described in a. In addition, any extreme events that have occurred since the last inspection should also be included. The Guide relies on the experience and judgement of the inspector to determine the extent to which need for corrective action should be warranted. ***(7) Corrective Actions:*** As described in Acceptance Criteria, the inspection report includes provisions for technical assessment of the causes of distress or abnormal conditions and recommendations for remedial or mitigating measures. Therefore, issues related to corrective actions, including root cause determination and prevention of recurrence are adequately addressed by the Guide. ***(8) Confirmation Process:*** The Guide states that any abnormal hazardous conditions observed during the inspection should be immediately reported to the NRC staff in accordance with the commission's regulations, as summarized in Regulatory Guide 1.16, "Reporting of Operating Information – Appendix A Technical Specifications". ***(9) Administrative Controls:*** The on-site inspections are documented in the form of technical report and are retained on-site for reference purposes and NRC audits. ***(10) Operating Experience:*** Degradation of Water Control structures has been detected at a number of nuclear power plants, and in some cases has required remedial action. No loss of intended functions has resulted from these occurrences. Therefore, it can be concluded that the Reg. Guide 1.127 inspection programs have been successful in detecting significant degradation before loss of intended function occurs.	

III STRUCTURES AND COMPONENT SUPPORTS

A6. Group 6 Structures (Water-control structures)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A6.1	Concrete	Exterior Above and Below Grade; Foundation; Interior Slab	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	Regulatory Guide 1.127
A6.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	Regulatory Guide 1.127
A6.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	Regulatory Guide 1.127
A6.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	Regulatory Guide 1.127
A6.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	Regulatory Guide 1.127
A6.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Regulatory Guide 1.127 Note: Leaching of calcium hydroxide may be non-significant. See A1.1 for technical basis	See program description and evaluation above.	No. Acceptable method for managing aging effect.
Regulatory Guide 1.127 Note: Reaction with aggregates may be non-significant. See A1.1 for technical basis	See program description and evaluation above.	No. Acceptable method for managing aging effect.
Regulatory Guide 1.127 Note: Corrosion of embedded steel may be non-significant. See A1.1 for technical basis	See program description and evaluation above.	No. Acceptable method for managing aging effect.
Regulatory Guide 1.127 Note: Aggressive chemical attack may be non-significant. See A1.1 for technical basis	See program description and evaluation above.	No. Acceptable method for managing aging effect.
Regulatory Guide 1.127	See program description and evaluation above.	No. Acceptable method for managing aging effect.
Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*

A6. Group 6 Structures (Water-control structures)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A6.1	Concrete	Exterior Above and Below Grade; Foundation; Interior Slab	Reinforced Concrete	Flowing Water	Loss of material	Abrasion; Cavitation	Regulatory Guide 1.127
A6.2	Steel Compo-nents	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	Regulatory Guide 1.127
A6.3	Masonry Walls	Intake Structure; Cooling Tower	Concrete Block	Various	Cracking	Restraint; Shrinkage; Creep; Aggressive Environ-ment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Regulatory Guide 1.127	See program description and evaluation above.	No. Acceptable method for managing aging effect.
Regulatory Guide 1.127	See program description and evaluation above.	No. Acceptable method for managing aging effect.
Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*	*Same as A1.3, Cracking due to Restraint; Shrinkage; Creep; Aggressive Environment*

A7. Group 7 Structures (Concrete Tanks)

A7.1 Concrete Elements
A7.2 Steel Elements

A7. Group 7 Structures (Concrete Tanks)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A7 addresses the elements of Concrete Tanks. For this group, the applicable structural elements are identified: concrete and steel. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A7. Group 7 Structures (Concrete Tanks)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A7.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking, Spalling	Freeze/ Thaw	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
A7.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
A7.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A7.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
A7.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

A7. Group 7 Structures (Concrete Tanks)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/Thaw Aging Mechanism	*Same as A1.1, Freeze/*Thaw Aging Mechanism	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
Same as A1.1, Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A7. Group 7 Structures (Concrete Tanks)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A7.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as A1.1, Settlement Aging Mechanism*
A7.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
A7.2	Steel Compo-nents	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A7.2	Steel Compo-nents	Liner	Stainless Steel	Exposed to Fluid Environ-ment (water, fuel)	Crack Initiation and Growth, Loss of Material	Stress Corrosion Cracking, Crevice Corrosion	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Settlement Aging Mechanism	*Same as A1.1, Settlement Aging Mechanism*	*Same as A1.1, Settlement Aging Mechanism*
Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*	*Same as A1.1, Erosion of Porous Concrete Subfounda-tion Aging Mechanism*
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism*	*Same as A1.2, Corrosion Aging Mechanism*
Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism	*Maintenance Rule – see A1.1, Freeze/Thaw Aging Mechanism* Plant-specific evaluation to ensure the aging effects of degradation due to stress corrosion cracking and crevice corrosion on liners will be managed to maintain their intended functions during the period of extended operation.	*Same as A1.1, Freeze/ Thaw Aging Mechanism*

A8. Group 8 Structures (Steel Tanks)

A8.1 Concrete Elements
A8.2 Steel Elements

A8. Group 8 Structures (Steel Tanks)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A8 addresses the elements of Steel Tanks. For this group, the applicable structural elements are identified: concrete and steel. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A8. Group 8 Structures (Steel Tanks)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A8.1	Concrete	Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking, Spalling	Freeze/ Thaw	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
A8.1	Concrete	Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
A8.1	Concrete	Foundation	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A8.1	Concrete	Foundation	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
A8.1	Concrete	Foundation	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

A8. Group 8 Structures (Steel Tanks)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/Thaw Aging Mechanism	*Same as A1.1, Freeze/*Thaw Aging Mechanism	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
Same as A1.1, Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A8. Group 8 Structures (Steel Tanks)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A8.1	Concrete	Foundation	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as A1.1, Settlement Aging Mechanism*
A8.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
A8.2	Steel Compo-nents	Structural Steel	Carbon Steel	Various	Loss of Material	Corrosion	*Same as A1.2, Corrosion Aging Mechanism*
A8.2	Steel Compo-nents	Liner	Stainless Steel	Exposed to Fluid Environ-ment	Crack Initiation and Growth, Loss of Material	Stress Corrosion Cracking, Crevice Corrosion	*Same as A7.2, Stress Corrosion Cracking, Crevice Corrosion Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Settlement Aging Mechanism	*Same as A1.1, Settlement Aging Mechanism*	*Same as A1.1, Settlement Aging Mechanism*
Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*
Same as A1.2, Corrosion Aging Mechanism	*Same as A1.2, Corrosion Aging Mechanism*	*Same as A1.2, Corrosion Aging Mechanism*
Same as A7.2, Stress Corrosion Cracking, Crevice Corrosion Aging Mechanism	*Same as A7.2, Stress Corrosion Cracking, Crevice Corrosion Aging Mechanism*	*Same as A7.2, Stress Corrosion Cracking, Crevice Corrosion Aging Mechanism*

A9. Group 9 Structures (BWR Unit Vent Stack)

A9.1 Concrete Elements

A9. Group 9 Structures (BWR Unit Vent Stack)

Systems, Structures, and Components

Class 1 structures are organized into nine groups and are discussed separately under subheadings A1 through A9. This format follows the presentation format in Section 3.9 of the draft Standard Review Plan for License Renewal (SRP-LR). Review Table III A9 addresses the elements of BWR Unit Vent Stack. For this group, the applicable structural elements are identified: concrete. The aging management review is presented for each applicable structural element/aging effect combination.

System Interfaces

Physical interfaces exist with any system or component which either penetrates the structure wall or is supported by the structure wall, floor and roof. The direct interface is through the system/component supports which are anchored to the structure. A primary functional interface is protection of housed systems or components from internal/external design basis events. In the case of tanks, there is a functional interface with the associated system. Water control structures are an integral part of the systems which provide plant cooling water and residual heat removal.

III STRUCTURES AND COMPONENT SUPPORTS

A9. Group 9 Structures (BWR unit vent stacks)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A9.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Weather Exposed	Scaling, Cracking, Spalling	Freeze/ Thaw	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
A9.1	Concrete	Exterior Above and Below Grade; Foundation	Reinforced Concrete	Flowing Water	Increase in Porosity and Perme-ability, Loss of Strength	Leaching of Calcium Hydroxide	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
A9.1	Concrete	All	Reinforced Concrete	Any	Expansion & Cracking	Reaction with Aggregates	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
A9.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Cracking, Spalling, Loss of Bond, Loss of Material	Corrosion of Embedded Steel	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
A9.1	Concrete	All	Reinforced Concrete	Exposure to Aggressive Environ-ment	Increase in Porosity and Perme-ability, Cracking, Spalling	Aggressive Chemical Attack	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

A9. Group 9 Structures (BWR unit vent stacks)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Freeze/Thaw Aging Mechanism	*Same as A1.1, Freeze/*Thaw Aging Mechanism	*Same as A1.1, Freeze/ Thaw Aging Mechanism*
Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*	*Same as A1.1, Leaching of Calcium Hydroxide Aging Mechanism*
Same as A1.1, Reaction with Aggregates Aging Mechanism	*Same as A1.1, Reaction with Aggregates Aging Mechanism*	*Same as A1.1, Reaction with Aggregates Aging Mechanism*
Same as A1.1, Corrosion of Embedded Steel Aging Mechanism	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*	*Same as A1.1, Corrosion of Embedded Steel Aging Mechanism*
Same as A1.1, Aggressive Chemical Attack Aging Mechanism	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*	*Same as A1.1, Aggressive Chemical Attack Aging Mechanism*

III STRUCTURES AND COMPONENT SUPPORTS

A9. Group 9 Structures (BWR unit vent stacks)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
A9.1	Concrete	All	Reinforced Concrete	Soft Soil; Changes in Ground-water Conditions	Cracks; Distortion; Increase in Compo-nent Stress Level	Settlement	*Same as A1.1, Settlement Aging Mechanism*
A9.1	Concrete	Foundation	Reinforced Concrete	Flowing Water Under Foundation	Reduction in Founda-tion Strength	Erosion of Porous Concrete Subfounda-tion	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as A1.1, Settlement Aging Mechanism	*Same as A1.1, Settlement Aging Mechanism*	*Same as A1.1, Settlement Aging Mechanism*
Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*	*Same as A1.1, Erosion of Porous Concrete Subfoundation Aging Mechanism*

CHAPTER III B

COMPONENT SUPPORTS

Draft December 6, 1999

Major Component Supports

B1. Supports for ASME Class Piping and Components

B2. Supports for Cable Trays, Conduit, HVAC Ducts, TubeTrack, Instrument Tubing, Non-ASME Piping and Components

B3. Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

B4. Supports for Miscellaneous Mechanical Equipment (e.g., Cranes, EDG, HVAC System Components)

B5. Supports for Miscellaneous Steel Structures (e.g., Platforms, Pipe Whip Restraints, Jet Impingement Shields)

B1. Supports for ASME Class Piping and Components

B1.1 Class 1

- B1.1.1 Support Members; Anchor Bolts; Welds
- B1.1.2 High Strength Bolting for Major NSSS Component Supports
- B1.1.3 Constant/Variable Load Spring Hangers; Guides; Stops; Sliding Surfaces; Design Clearances
- B1.1.4 Building Concrete Surrounding Anchor Bolts; Grout Pads

B1.2 Class 2, 3 and MC

- B1.2.1 Support Members; Anchor Bolts; Welds
- B1.2.2 Constant/Variable Load Spring Hangers; Guides; Stops; Sliding Surfaces; Design Clearances
- B1.2.3 Building Concrete Surrounding Anchor Bolts; Grout Pads

B1. Supports for ASME Class Piping and Components

Systems, Structures, and Components

Review Table III B1 addresses supports/anchorage for ASME Class piping systems and associated components. B1 is further subdivided into Class 1 (B1.1) and Class 2, 3, and MC (B1.2). Component supports are not specifically addressed in the draft Standard Review Plan for License Renewal (SRP-LR). Regions of interest and applicable aging effects are identified in the Table. The aging management review is presented for each region of interest /aging effect combination.

System Interfaces

Physical interfaces exist with the structure, system or component being supported and with the building structural element to which the support is anchored. The primary functional interface is to ensure adequate anchorage of the supported element during internal/external design basis events, so that the supported element can perform its intended function.

III. STRUCTURES AND COMPONENT SUPPORTS

B1.1 Supports for ASME Class 1 Piping and Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.1.1	Class 1 Piping and component supports	Support Members; Anchor Bolts; Welds	Carbon Steel	Inside Contain-ment	Loss of Material	Environ-mental Corrosion	10CFR50.55a ASME Section XI, Subsection IWF, 1989

III. STRUCTURES AND COMPONENT SUPPORTS

B1.1 Supports for ASME Class 1 Piping and Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10CFR50.55a imposes the inservice inspection requirements of ASME B&PV Code Section XI on Class 1, 2, and 3 piping and components and their associated supports. Inservice inspection of supports is covered in Subsection IWF. Therefore, ASME Code Section XI, Subsection IWF constitutes an existing mandated program which may be credited for managing aging of supports for license renewal.	***(1) Scope of Program:*** IWF (1989 Edition) refers to IWB for inspection scope and schedule. It can be inferred from Table IWB-2500-1, Examination Category B-J "Pressure Retaining Welds in Piping," Note (1)(d) that only 25% of non-exempted supports are subject to examination. The same supports are inspected in each 10 year inspection interval. ***(2) Preventative Action:*** No preventive actions are specified; IWF is a monitoring program. ***(3) Parameters Monitored/Inspected:*** As part of the visual examination (VT-3), general corrosion which would reduce the structural capacity of the support is noted. ***(4) Detection:*** Only visual examination is performed; the qualified VT-3 inspector uses judgement in assessing general corrosion; it is not documented unless loss of structural capacity is suspected. ***(5) Monitoring and Trending:*** There is no requirement to monitor or report progressive, time-dependent degradation. Unacceptable conditions, per IWF-3400 are noted for correction or further evaluation . Since the same supports are monitored, each inspection interval, trending is possible, but not required. ***(6) Acceptance Criteria:*** These are provided in IWF-3410. Under (b)(5), "roughness or general corrosion which does not reduce the load bearing capacity of the support" is given as an example of a "nonrelevant condition." ***(7) Corrective Actions:*** These are delineated in IWF-3122.2; IWF-3122.3 provides an alternative for evaluation/testing to substantiate integrity for intended purpose. Identification of unacceptable conditions triggers an expansion of the inspection scope, per IWF-2430, and re-examination of the supports requiring corrective action during the next inspection period (3 years), per IWF-2420(b). ***(8) Confirmation Process:*** Documentation of inspection results, corrective actions and evaluations is required. This would typically be reviewed by the Authorized Nuclear Inspector. ***(9) Administrative Controls:*** An approved site QA Program would be applicable to IWF inspections of supports. ***(10) Operating Experience:*** To date, IWF sampling inspections appear to be effective in managing aging effects. If sampling is inadequate, it will likely come to light as plants age. Revisions to IWF inspection scope would be expected in this case.	No

III. STRUCTURES AND COMPONENT SUPPORTS

B1.1 Supports for ASME Class 1 Piping and Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.1.1	Class 1 Piping and component supports	Support Members; Anchor Bolts; Welds	Carbon Steel	Inside PWR Contain-ment	Loss of Material	Boric Acid Corrosion	NRC GL 88-05 IE Bulletin 82-02 IE IN 80-27 IE IN 86-108 Supplements 1,2, and 3
B1.1.1	Class 1 Piping and component supports	Support Members; Anchor Bolts; Welds	Carbon Steel	Inside Contain-ment	Crack initiation and Growth	Fatigue	10CFR50.55a ASME Section XI, Subsection IWF, 1989 ASME Section III, Subsection NF

III. STRUCTURES AND COMPONENT SUPPORTS

B1.1 Supports for ASME Class 1 Piping and Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Generic Letter 88-05 "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988 mandates that PWR licensees monitor the condition of the reactor coolant pressure boundary for occurrences of borated water leakage. Periodic Visual Inspection of adjacent structures, components and supports for evidence of leakage and corrosion should be an element of the applicant's 88-05 monitoring program.	***(1) Scope of Program:*** The primary coolant pressure boundary of PWR's, containing borated water, must be monitored for early detection of small leaks, in order to prevent significant loss of material from boric acid corrosion. Early detection and correction of leakage should protect adjacent structural elements (e.g., supports) from boric acid corrosion. ***(2) Preventative Action:*** This is primarily a monitoring program, in addition to any regular preventive maintenance. ***(3) Parameters Monitored/Inspected:*** The required program includes 1) identification of locations where leaks smaller than technical specification limits can cause degradation of the pressure boundary by boric acid corrosion, and 2) development and implementation of procedures for locating small coolant leaks. ***(4) Detection:*** The mandated monitoring program includes methods for conducting examinations to detect leakage. Engineering evaluations are then performed to establish the impact on the reactor coolant pressure boundary when leakage is located. ***(5) Monitoring and Trending:*** No monitoring or trending activities for assessing the impact of boric acid corrosion on carbon steel reactor pressure boundary components in PWR plants are required by this monitoring program. ***(6) Acceptance Criteria:*** No acceptance criteria are specified by NRC monitoring program. Methods must be capable of detecting leaks smaller then technical specification limits. ***(7) Corrective Action:*** Corrective actions are taken to prevent recurrence of this type of corrosion. This includes modifications in design and operating procedures as necessary to reduce the probability of primary coolant leaks and the use of suitable corrosion resistant materials or the application of protective coatings/claddings. ***(8) Confirmation Process:*** Licenses were required to respond to GL 88-05 within 60 days providing assurances that the mandated program was in place or to be promptly implemented. ***(9) Administrative Control:*** The Licensees shall maintain records of the programs and results obtained . ***(10) Operating Experience:*** Objective evidence indicates that boric acid corrosion of steel supports and other structural elements is adequately managed by the existing program.	No, provided visual inspection of adjacent areas is included in applicant's program. Otherwise, plant-specific evaluation will be required.
10CFR50.55a imposes the inservice inspection requirements of ASME B&PV Code Section XI on Class 1, 2, and 3 piping and components <u>and their associated supports</u>. Inservice inspection of supports is covered in Subsection IWF. Therefore, ASME Code Section XI, Subsection IWF constitutes an existing mandated program which may be credited for managing aging of supports for license renewal.	***(1) Scope of Program and (2) Preventative Action:*** Same as under "Environmental Corrosion." ***(3) Parameters Monitored/Inspected:*** Although cracking is not explicitly noted in IWF, the visual inspection (VT-3) would be expected to identify cracks. ***(4) Detection:*** Visual inspection would detect surface cracks, at a mature stage of crack growth, ***(5) Monitoring and Trending:*** An observed crack would be immediately identified for corrective action and/or detailed evaluation. Monitoring would be inappropriate. ***(6) Acceptance Criteria:*** Observation of a crack would be identified as an unacceptable condition, which must be addressed immediately.	No

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.1.2	Class 1 Piping and component supports	High strength bolting for major NSSS component supports	Low alloy steel, tensile strength >150 ksi	Inside contain-ment	Crack initiation and growth	Stress corrosion cracking	NRC GL 91-17 EPRI NP-5769 NUREG-1339 IE Bulletin 74-03 IE Bulletin 82-02

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(7) Corrective Actions, (8) Confirmation Process, (9) Administrative Controls, (10) Operating Experience: same as under "Environmental Corrosion."	
Some supports may have been designed for a finite number of load cycles, per Section III, Subsection NF, based on a 40 year design life.	Supports designed for a specific number of load cycles will require a TLAA to demonstrate adequacy for the renewal license period.	Yes. Possible TLAA.
Generic Letter 91-17, "Generic Safety Issue 29: Bolting Degradation in Nuclear Power Plants" documents the resolution of GSI-29 and acceptable methods for ensuring bolting reliability, including protection against Stress Corrosion Cracking.	The resolution of GSI 29 should be sufficient to manage degradation due to SCC. The adequacy of this program as an aging management program is evaluated against the 10 criteria identified in draft SRP-LR. ***(1) Scope of Program:*** This program identified component support bolting which may be susceptible to SCC and provided recommendations for both generic and plant-specific review procedures to address the issue and implement appropriate corrective measures. ***(2) Preventive Actions:*** Monitoring program does not require the use of Preventive actions. However, the program promoted awareness of the material parameters and poor bolting practices that contribute to SCC failure. Video cassette training programs and training manuals addressing good bolting practice evolved and provide a basis to prevent recurrence. ***(3) Parameters Monitored/Inspected:*** A screening procedure to review bolting applications was developed. Parameters screened included the minimum yield strength of the bolts, stress level, and assumed size of flaw factors. ***(4) Detection:*** A screening program required the identification of susceptible bolting based on pre-service and in-service failure data, material specifications, and bolting stress. Bolting failing to meet the criteria are subject to mechanical tests to verify material strength properties. ***(5) Monitoring and Trending:*** No monitoring or trending activities to assess continued bolt integrity is defined in this program. ***(6) Acceptance Criteria:*** Probabilistic methods are used to verify fastener pre-load and material parameters for populations of fasteners. Populations are then accepted, rejected, or subject to sample inspection based on screening results. ***(7) Corrective Action:*** Populations of fasteners failing to meet screening parameters are dispositioned by retightening/retensioning, mechanical test, fracture and failure analysis, in-service inspection, and replacement. ***(8) Confirmation Process:*** No specific confirmation process was required by GL 91-17. ***(9) Administrative Control:*** No specific Administrative action was required by GL 91-17. ***(10) Operating Experience:*** Lack of continuing problems would indicate that SCC of support bolting is adequately managed by the industry program.	No, provided applicant commits to GL 91-17 to manage this aging effect. Otherwise, plant-specific evaluation is needed.

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.1.3	Class 1 Piping and component supports	Constant and variable load spring hangers; guides; stops; sliding surfaces; design clearances; vibration isolators	Steel and other	Inside contain-ment	Loss of mecha-nical function	Corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads; elastomer hardening	10CFR50.55a ASME Section XI, Subsection IWF, 1989
B1.1.4	Class 1 Piping and component supports	Building concrete surround-ing anchor bolts; Grout pads	Reinforced concrete and grout	Inside contain-ment	Reduction in concrete anchor capacity	Concrete degradation due to vibratory loads or other effects	10CFR50.65 NUMARC 93-01, Revision 2 NRC Regulatory Guide 1.160 (formerly Draft DG-1051)

III. STRUCTURES AND COMPONENT SUPPORTS

B1.1 Supports for ASME Class 1 Piping and Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10CFR50.55a imposes the inservice inspection requirements of ASME B&PV Code Section XI on Class 1, 2, and 3 piping and components and their associated supports. Inservice inspection of supports is covered in Subsection IWF. Therefore, ASME Code Section XI, Subsection IWF constitutes an existing mandated program which may be credited for managing aging of supports for license renewal.	***(1) Scope of Program and (2) Preventative Actions:*** Same as under "Environmental Corrosion," ***(3) Parameters Monitored/Inspected:*** Table IWF-2500-1 specifies examination of the following: (F1.10) Mechanical connections to pressure retaining components and building structure; (F1.20) Weld connections to building structure; (F1.30) Weld and mechanical connections at intermediate joints in multi-connected integral and non-integral supports; (F1.40) Clearances of guides and stops, alignment of supports, assembly of support items; (F1.50) Spring supports and constant load supports; (F1.60) Sliding Surfaces; (F1.70) Hot or cold position of spring supports and constant load supports. ***(4) Detection:*** VT-3 visual examination is specified in Table IWF-2500-1. ***(5) Monitoring and Trending:*** Same as under "Environmental Corrosion." ***(6) Acceptance Criteria:*** These are provided in IWF-3410. The following conditions are unacceptable: (i) deformations or structural degradations of fasteners, springs, clamps, or other support items; (ii) missing, detached, or loosened support items; (iii) arc strikes, weld spatter, paint, scoring, roughness, or general corrosion on close tolerance machined or sliding surfaces; (iv) improper hot or cold positions of spring supports and constant load supports; (v) misalignment of supports; (vi) improper clearances of guides and stops. ***(7) Corrective Actions, (8) Confirmation Process, (9) Administrative Controls,*** and ***(10) Operating Experience:*** Same as under "Environmental Corrosion."	No
Maintenance Rule (10CFR50.65) -Structures monitoring The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65.	An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures and component supports will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for an acceptable aging management program follows: **(1) Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect/aging mechanism combinations which are managed by the MR Structures Monitoring Program. For potential structure/aging effect/aging mechanism combinations not covered by the MR Structures Monitoring Program, the applicant should justify that it is not significant for the applicant's plant, or identify the applicable aging management program.	No, if within the scope of the applicant's MR Structures Monitoring Program. Otherwise, justification for non-applicability or details of plant-specific program need to be evaluated.

III. STRUCTURES AND COMPONENT SUPPORTS

B1.1 Supports for ASME Class 1 Piping and Components

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structure monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License Renewal applicants are encouraged to take credit for existing programs. A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal. The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structures monitoring under the Maintenance Rule. Plant-specific structures monitoring programs are identified and described, to demonstrate that adequate aging management programs are in place for structures and structural components. These programs were evaluated by the staff against the ten (10) criteria for an acceptable aging management program, defined in Section 3.0 of the Draft SRP-LR. For the most part, these programs are considered	**(2) Preventive Actions:** Inspection and maintenance of protective coatings which inhibit corrosion of steel structural elements should be included as part of Structures Monitoring. No specific preventive actions are identified for other aging mechanisms. **(3) Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters monitored or inspected is the responsibility of the licensee. For License Renewal, the specific parameters monitored or inspected should be linked to degradation of intended function(s) and should detect the presence and extent of aging effects. The inspection scope should include bolt-tightness checks for concrete expansion anchors subjected to vibratory loads. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. **(4) Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the inspection schedule, inspection methods and inspector qualifications are defined by the individual licensees. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4. **(5) Monitoring and Trending:** Documentation and comparison of successive inspection results is needed to perform meaningful trending. An appropriate inspection schedule should be established to provide reasonable assurance that adequate monitoring and trending will be accomplished under the MR Structure Monitoring Program. **(6) Acceptance Criteria:** Acceptance criteria, against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. These criteria are defined on a licensee-specific basis. The acceptance criteria should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the acceptance criteria utilized in its MR Structures Monitoring Program will provide for timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. **(7) Corrective Actions:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Corrective Action requirement of Criterion 7 is satisfied. **(8) Confirmation Process:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Confirmation requirement of Criterion 8 is satisfied.	

III. STRUCTURES AND COMPONENT SUPPORTS

B1.1 Supports for ASME Class 1 Piping and Components

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria.. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal.	**(9) Administrative Controls:** Provided the MR Structures Monitoring Program is conducted under 10CFR50 Appendix B (Quality Assurance), the Administrative Controls requirement of Criterion 9 is satisfied. **(10) Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation which threatens intended functions have only recently been implemented. At this time, it appears that MR Structures Monitoring should be an effective program, provided the details of licensee-specific programs adequately address Criteria 1, 3, 4, and 6.	

III. STRUCTURES AND COMPONENTS SUPPORTS

B1.2 Supports for ASME Class 2, 3 and MC Piping and Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.2.1	Class 2, 3, MC Piping and component supports	Support Members; Anchor Bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Loss of Material	Environ-mental corrosion	10CFR50.55a ASME Section XI, Subsection 1WF, 1989
B1.2.1	Class 2, 3, MC Piping and component supports	Support Members; Anchor Bolts; Welds	Carbon Steel	Inside PWR contain-ment	Loss of Material	Boric Acid Corrosion	*Same as effect of boric acid corrosion on Class 1 piping and component supports (B1.1.1)*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10CFR50.55a imposes the inservice inspection requirements of ASME B&PV Code Section XI on Class 1, 2, and 3 piping and components and their associated supports. Inservice inspection of supports is covered in Subsection IWF. Therefore, ASME Code Section XI, Subsection IWF constitutes an existing mandated program which may be credited for managing aging of supports for license renewal.	**(1) Scope of Program:** IWF (1989 Edition) refers to IWC, IWD, and IWE for the inspection scope and schedule. It can be inferred from Table IWC-2500-1, Examination Categories C-F-1 and C-F-2 that only 7.5% of non-exempted supports are subject to examination for Class 2 systems. The same supports are inspected in each 10 year inspection interval. No specific numerical percentages are inferred in IWD and IWE for Class 3 and Class MC respectively. For other 9 criteria as delineated in draft SRP-LR (i.e., from **(2) Preventative Action** to **(10) Operating Experience**), *same as effect of environmental corrosion on Class 1 piping and component supports (B1.1.1)*	No
Same as effect of boric caid corrosion on Class 1 piping and component supports (B1.1.1)	*Same as effect of boric acid corrosion on Class 1 piping and component supports (B1.1.1)*	*Same as effect of boric acid corrosion on Class 1 piping and component supports (B1.1.1)*

B1.2 Supports for ASME Class 2, 3 and MC Piping and Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.2.1	Class 2, 3, MC Piping and component supports	Support Members; Anchor Bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Crack initiation and Growth	Fatigue	*Same as effect of fatigue on Class 1 piping and component supports (B1.1.1)*
B1.2.2	Class 2, 3, MC Piping and component supports	Constant and variable load spring hangers; guides; stops; sliding surfaces; design clearances; vibration isolators	Steel and other	Inside contain-ment/ Outside contain-ment	Loss of mechani-cal function	Corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads; elastomer hardening	*Same as effect of corrosion, distortion, dirt etc. on Class 1 piping and component supports (B1.1.3)*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as effect of fatigue on Class 1 piping and component supports (B1.1.1)	*Same as effect of fatigue on Class 1 piping and component supports (B1.1.1)*	*Same as effect of fatigue on Class 1 piping and component supports (B1.1.1)*
Some supports may have been designed for a finite number of load cycles, per Section III, Subsection NF, based on a 40 year design life.	Supports designed for a specific number of load cycles will require a TLAA to demonstrate adequacy for the renewal license period.	Yes. Possible TLAA.
Same as effect of corrosion, distortion, dirt etc. on Class 1 piping and component supports (B1.1.3)	*Same as effect of corrosion, distortion, dirt etc. on Class 1 piping and component supports (B1.1.3)*	*Same as effect of corrosion, distortion, dirt etc. on Class 1 piping and component supports (B1.1.3)*

III. STRUCTURES AND COMPONENTS SUPPORTS

B1.2 Supports for ASME Class 2, 3 and MC Piping and Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B1.2.3	Class 2, 3, MC Piping and component supports	Building concrete surround-ing anchor bolts; Grout pads	Reinforced concrete and grout	Inside contain-ment/ Outside contain-ment	Reduction in concrete anchor capacity	Concrete degradation due to vibratory loads or other effects	*Same as effect of concrete degradation on Class 1 piping and component supports (B1.1.4)*

III. STRUCTURES AND COMPONENTS SUPPORTS

B1.2 Supports for ASME Class 2, 3 and MC Piping and Components

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Same as effect of concrete degradation *on Class 1 piping and component supports (B1.1.4)*	*Same as effect of* concrete degradation *on Class 1 piping and component supports (B1.1.4)*	*Same as effect of* concrete degradation *on Class 1 piping and component supports (B1.1.4)*

B2. Supports for Cable Trays, Conduit, HVAC Ducts, TubeTrack, Instrument Tubing, Non-ASME Piping and Components

B2.1 Support Members; Anchor Bolts; Welds
B2.2 Bolted Friction Connections (e.g. Struts)
B2.3 Building Concrete Surrounding Anchor Bolts; Grout Pads

B2. Supports for Cable Trays, Conduit, HVAC Ducts, TubeTrack, Instrument Tubing, Non-ASME Piping and Components

Systems, Structures, and Components

Review Table III B2 addresses supports/anchorage for cable trays, conduit, HVAC ducts, Tube Track, instrument tubing, and non-ASME piping/components. Component supports are not specifically addressed in the draft Standard Review Plan for License Renewal (SRP-LR). Regions of interest and applicable aging effects are identified in the Table. The aging management review is presented for each region of interest /aging effect combination.

System Interfaces

Physical interfaces exist with the structure, system or component being supported and with the building structural element to which the support is anchored. The primary functional interface is to ensure adequate anchorage of the supported element during internal/external design basis events, so that the supported element can perform its intended function.

III. STRUCTURES AND COMPONENT SUPPORTS

B2 Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Loss of Material	Environ-mental Corrosion	10CFR50.65 NUMARC 93-01, Revision 2 Regulatory Guide 1.160 (formerly Draft DG-1051

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule (10CFR50.65) -Structures monitoring The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structure monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License	An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures and component supports will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for an acceptable aging management program follows: **(1)Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect/aging mechanism combinations which are managed by the MR Structures Monitoring Program. For potential structure/aging effect/aging mechanism combinations not covered by the MR Structures Monitoring Program, the applicant should justify that it is not significant for the applicant's plant, or identify the applicable aging management program. **(2) Preventive Actions:** Inspection and maintenance of protective coatings which inhibit corrosion of steel structural elements should be included as part of Structures Monitoring. No specific preventive actions are identified for other aging mechanisms. **(3) Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters monitored or inspected is the responsibility of the licensee. For License Renewal, the specific parameters monitored or inspected should be linked to degradation of intended function(s) and should detect the presence and extent of aging effects. The inspection scope should include bolt-tightness checks for concrete expansion anchors subjected to vibratory loads. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. **(4) Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the inspection schedule, inspection methods and inspector qualifications are defined by the individual licensees. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4.	No, if within the scope of the applicant's MR Structures Monitoring Program. Otherwise, justification for non-applicability <u>or</u> details of plant-specific program need to be evaluated.

III. STRUCTURES AND COMPONENT SUPPORTS

B2 Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside PWR contain-ment	Loss of Material	Boric Acid Corrosion	GL 88-05 IE Bulletin 82-02 IE IN 80-27 IE IN 86-108 Supplements 1, 2, and 3

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Renewal applicants are encouraged to take credit for existing programs. A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal. The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structures monitoring under the Maintenance Rule. Plant-specific structures monitoring programs are identified and described, to demonstrate that adequate aging management programs are in place for structures and structural components. These programs were evaluated by the staff against the ten (10) criteria for an acceptable aging management program, defined in Section 3.0 of the Draft SRP-LR. For the most part, these programs are considered adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria.. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal.	**(5) Monitoring and Trending:** Documentation and comparison of successive inspection results is needed to perform meaningful trending. An appropriate inspection schedule should be established to provide reasonable assurance that adequate monitoring and trending will be accomplished under the MR Structure Monitoring Program. **(6) Acceptance Criteria:** Acceptance criteria, against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. These criteria are defined on a licensee-specific basis. The acceptance criteria should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the acceptance criteria utilized in its MR Structures Monitoring Program will provide for timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. **(7) Corrective Actions:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Corrective Action requirement of Criterion 7 is satisfied. **(8) Confirmation Process:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Confirmation requirement of Criterion 8 is satisfied. **(9) Administrative Controls:** Provided the MR Structures Monitoring Program is conducted under 10CFR50 Appendix B (Quality Assurance), the Administrative Controls requirement of Criterion 9 is satisfied. **(10) Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation which threatens intended functions have only recently been implemented. At this time, it appears that MR Structures Monitoring should be an effective program, provided the details of licensee-specific programs adequately address Criteria 1, 3, 4, and 6.	
Generic Letter 88-05 "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988 mandates that PWR licensees monitor the condition of the reactor coolant pressure boundary for occurrences of borated water leakage. Periodic Visual Inspection of adjacent structures, components and supports for evidence of leakage and corrosion should be an element of the applicant's 88-05 monitoring program.	***(1) Scope of Program:*** The primary coolant pressure boundary of PWR's, containing borated water, must be monitored for early detection of small leaks, in order to prevent significant loss of material from boric acid corrosion. Early detection and correction of leakage should protect adjacent structural elements (e.g., supports) from boric acid corrosion. ***(2) Preventative Action:*** This is primarily a monitoring program, in addition to any regular preventive maintenance.	No, provided visual inspection of adjacent areas is included in applicant's program. Otherwise, plant-specific evaluation will be required.

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B2.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Crack initiation and Growth	Fatigue	*Same as B2.1, Loss of material due to Environ-mental Corrosion*
B2.2	All	Bolted friction connections (e.g., struts)	Steel	Inside contain-ment/ Outside contain-ment	Loose-ning/ slipping of conn-ections	Thermal cycling/ vibration	*Same as B2.1, Loss of material due to Environ-mental Corrosion*
B2.3	All	Building concrete surround-ing anchor bolts; Grout pads	Reinforced concrete, grout, masonry	Inside contain-ment/ Outside contain-ment	Reduction in concrete anchor capacity	Concrete degradation due to vibratory loads or other effects	*Same as B2.1, Loss of material due to Environ-mental Corrosion*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(3) Parameters Monitored/Inspected: The required program includes 1) identification of locations where leaks smaller than technical specification limits can cause degradation of the pressure boundary by boric acid corrosion, and 2) development and implementation of procedures for locating small coolant leaks. ***(4) Detection:*** The mandated monitoring program includes methods for conducting examinations to detect leakage. Engineering evaluations are then performed to establish the impact on the reactor coolant pressure boundary when leakage is located. ***(5) Monitoring and Trending:*** No monitoring or trending activities for assessing the impact of boric acid corrosion on carbon steel reactor pressure boundary components in PWR plants are required by this monitoring program. ***(6) Acceptance Criteria:*** No acceptance criteria are specified by NRC monitoring program. Methods must be capable of detecting leaks smaller then technical specification limits. ***(7) Corrective Action:*** Corrective actions are taken to prevent recurrence of this type of corrosion. This includes modifications in design and operating procedures as necessary to reduce the probability of primary coolant leaks and the use of suitable corrosion resistant materials or the application of protective coatings/claddings. ***(8) Confirmation Process:*** Licenses were required to respond to GL 88-05 within 60 days providing assurances that the mandated program was in place or to be promptly implemented. ***(9) Administrative Control:*** The Licensees shall maintain records of the programs and results obtained . ***(10) Operating Experience:*** Objective evidence indicates that boric acid corrosion of steel supports and other structural elements is adequately managed by the existing program.	
Same as B2.1, Loss of material due to Environmental Corrosion	*Same as B2.1, Loss of material due to Environmental Corrosion*	*Same as B2.1, Loss of material due to Environmental Corrosion*
Same as B2.1, Loss of material due to Environmental Corrosion	*Same as B2.1, Loss of material due to Environmental Corrosion*	*Same as B2.1, Loss of material due to Environmental Corrosion*
Same as B2.1, Loss of material due to Environmental Corrosion	*Same as B2.1, Loss of material due to Environmental Corrosion*	*Same as B2.1, Loss of material due to Environmental Corrosion*

B3. Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

B3.1 Support Members; Anchor Bolts; Welds

B3.2 Building Concrete Surrounding Anchor Bolts; Grout Pads

B3. Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

Systems, Structures, and Components

Review Table III B3 addresses supports/anchorage for racks, panels, cabinets, and enclosures for electrical equipment and instrumentation. Component supports are not specifically addressed in the draft Standard Review Plan for License Renewal (SRP-LR). Regions of interest and applicable aging effects are identified in the Table. The aging management review is presented for each region of interest /aging effect combination.

System Interfaces

Physical interfaces exist with the structure, system or component being supported and with the building structural element to which the support is anchored. The primary functional interface is to ensure adequate anchorage of the supported element during internal/external design basis events, so that the supported element can perform its intended function.

B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Loss of Material	Environ-mental Corrosion	10CFR50.65 NUMARC 93-01, Revision 2 Regulatory Guide 1.160 (formerly Draft DG-1051)

B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule (10CFR50.65) -Structures monitoring The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structure monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License	An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures and component supports will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for an acceptable aging management program follows: **(1)Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect/aging mechanism combinations which are managed by the MR Structures Monitoring Program. For potential structure/aging effect/aging mechanism combinations not covered by the MR Structures Monitoring Program, the applicant should justify that it is not significant for the applicant's plant, or identify the applicable aging management program. **(2) Preventive Actions:** Inspection and maintenance of protective coatings which inhibit corrosion of steel structural elements should be included as part of Structures Monitoring. No specific preventive actions are identified for other aging mechanisms. **(3) Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters monitored or inspected is the responsibility of the licensee. For License Renewal, the specific parameters monitored or inspected should be linked to degradation of intended function(s) and should detect the presence and extent of aging effects. The inspection scope should include bolt-tightness checks for concrete expansion anchors subjected to vibratory loads. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. **(4) Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the inspection schedule, inspection methods and inspector qualifications are defined by the individual licensees. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4.	No, if within the scope of the applicant's MR Structures Monitoring Program. Otherwise, justification for non-applicability <u>or</u> details of plant-specific program need to be evaluated.

B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Renewal applicants are encouraged to take credit for existing programs. A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal. The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structures monitoring under the Maintenance Rule. Plant-specific structures monitoring programs are identified and described, to demonstrate that adequate aging management programs are in place for structures and structural components. These programs were evaluated by the staff against the ten (10) criteria for an acceptable aging management program, defined in Section 3.0 of the Draft SRP-LR. For the most part, these programs are considered adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria.. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal.	**(5) Monitoring and Trending:** Documentation and comparison of successive inspection results is needed to perform meaningful trending. An appropriate inspection schedule should be established to provide reasonable assurance that adequate monitoring and trending will be accomplished under the MR Structure Monitoring Program. **(6) Acceptance Criteria:** Acceptance criteria, against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. These criteria are defined on a licensee-specific basis. The acceptance criteria should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the acceptance criteria utilized in its MR Structures Monitoring Program will provide for timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. **(7) Corrective Actions:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Corrective Action requirement of Criterion 7 is satisfied. **(8) Confirmation Process:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Confirmation requirement of Criterion 8 is satisfied. **(9) Administrative Controls:** Provided the MR Structures Monitoring Program is conducted under 10CFR50 Appendix B (Quality Assurance), the Administrative Controls requirement of Criterion 9 is satisfied. **(10) Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation which threatens intended functions have only recently been implemented. At this time, it appears that MR Structures Monitoring should be an effective program, provided the details of licensee-specific programs adequately address Criteria 1, 3, 4, and 6.	

B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B3.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside PWR contain-ment	Loss of Material	Boric Acid Corrosion	NRC GL 88-05 IE Bulletin 82-02 IE IN 80-27 IE IN 86-108 Supplements 1,2, and 3
B3.2	All	Building concrete surround-ing anchor bolts; Grout pads	Reinforced concrete, grout, masonry	Inside contain-ment/ Outside contain-ment	Reduction in concrete anchor capacity	Concrete degradation	*Same as B3.1, Loss of material due to Environ-mental Corrosion*

B3 Anchorage of Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Generic Letter 88-05 "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988 mandates that PWR licensees monitor the condition of the reactor coolant pressure boundary for occurrences of borated water leakage. Periodic Visual Inspection of adjacent structures, components and supports for evidence of leakage and corrosion should be an element of the applicant's 88-05 monitoring program.	***(1) Scope of Program:*** The primary coolant pressure boundary of PWR's, containing borated water, must be monitored for early detection of small leaks, in order to prevent significant loss of material from boric acid corrosion. Early detection and correction of leakage should protect adjacent structural elements (e.g., supports) from boric acid corrosion. ***(2) Preventative Action:*** This is primarily a monitoring program, in addition to any regular preventive maintenance. ***(3) Parameters Monitored/Inspected:*** The required program includes 1) identification of locations where leaks smaller than technical specification limits can cause degradation of the pressure boundary by boric acid corrosion, and 2) development and implementation of procedures for locating small coolant leaks. ***(4) Detection:*** The mandated monitoring program includes methods for conducting examinations to detect leakage. Engineering evaluations are then performed to establish the impact on the reactor coolant pressure boundary when leakage is located. ***(5) Monitoring and Trending:*** No monitoring or trending activities for assessing the impact of boric acid corrosion on carbon steel reactor pressure boundary components in PWR plants are required by this monitoring program. ***(6) Acceptance Criteria:*** No acceptance criteria are specified by NRC monitoring program. Methods must be capable of detecting leaks smaller then technical specification limits. ***(7) Corrective Action:*** Corrective actions are taken to prevent recurrence of this type of corrosion. This includes modifications in design and operating procedures as necessary to reduce the probability of primary coolant leaks and the use of suitable corrosion resistant materials or the application of protective coatings/claddings. ***(8) Confirmation Process:*** Licenses were required to respond to GL 88-05 within 60 days providing assurances that the mandated program was in place or to be promptly implemented. ***(9) Administrative Control:*** The Licensees shall maintain records of the programs and results obtained. ***(10) Operating Experience:*** Objective evidence indicates that boric acid corrosion of steel supports and other structural elements is adequately managed by the existing program.	No, provided visual inspection of adjacent areas is included in applicant's program. Otherwise, plant-specific evaluation will be required.
Same as B3.1, Loss of material due to Environmental Corrosion	*Same as B3.1, Loss of material due to Environmental Corrosion*	*Same as B3.1, Loss of material due to Environmental Corrosion*

B4. Supports for Miscellaneous Mechanical Equipment (e.g., Cranes, EDG, HVAC System Components)

B4.1 Support Members; Anchor Bolts; Welds
B4.2 Vibration Isolation Elements
B4.3 Building Concrete Surrounding Anchor Bolts; Grout Pads

B4. Supports for Miscellaneous Mechanical Equipment (e.g., Cranes, EDG, HVAC System Components)

Systems, Structures, and Components

Review Table III B4 addresses supports/anchorage for miscellaneous mechanical equipment. Component supports are not specifically addressed in the draft Standard Review Plan for License Renewal (SRP-LR). Regions of interest and applicable aging effects are identified in the Table. The aging management review is presented for each region of interest /aging effect combination.

System Interfaces

Physical interfaces exist with the structure, system or component being supported and with the building structural element to which the support is anchored. The primary functional interface is to ensure adequate anchorage of the supported element during internal/external design basis events, so that the supported element can perform its intended function.

III. STRUCTURES AND COMPONENTS SUPPORTS

B4 Supports for Miscellaneous Mechanical Equipment (e.g., Cranes, EDG, HVAC System Components)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B4.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Loss of Material	Environ-mental Corrosion	10CFR50.65 NUMARC 93-01, Revision 2 Regulatory Guide 1.160 (formerly Draft DG-1051)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule (10CFR50.65) -Structures monitoring The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structure monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License	An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures and component supports will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for an acceptable aging management program follows: **(1)Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect/aging mechanism combinations which are managed by the MR Structures Monitoring Program. For potential structure/aging effect/aging mechanism combinations not covered by the MR Structures Monitoring Program, the applicant should justify that it is not significant for the applicant's plant, or identify the applicable aging management program. **(2) Preventive Actions:** Inspection and maintenance of protective coatings which inhibit corrosion of steel structural elements should be included as part of Structures Monitoring. No specific preventive actions are identified for other aging mechanisms. **(3) Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters monitored or inspected is the responsibility of the licensee. For License Renewal, the specific parameters monitored or inspected should be linked to degradation of intended function(s) and should detect the presence and extent of aging effects. The inspection scope should include bolt-tightness checks for concrete expansion anchors subjected to vibratory loads. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. **(4) Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the inspection schedule, inspection methods and inspector qualifications are defined by the individual licensees. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4.	No, if within the scope of the applicant's MR Structures Monitoring Program. Otherwise, justification for non-applicability <u>or</u> details of plant-specific program need to be evaluated.

B4 Supports for Miscellaneous Mechanical Equipment (e.g., Cranes, EDG, HVAC System Components)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B4.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside PWR contain-ment	Loss of Material	Boric Acid Corrosion	NRC GL 88-05 IE Bulletin 82-02 IE IN 80-27 IE IN 86-108 Supplements 1,2, and 3

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Renewal applicants are encouraged to take credit for existing programs. A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal. The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structures monitoring under the Maintenance Rule. Plant-specific structures monitoring programs are identified and described, to demonstrate that adequate aging management programs are in place for structures and structural components. These programs were evaluated by the staff against the ten (10) criteria for an acceptable aging management program, defined in Section 3.0 of the Draft SRP-LR. For the most part, these programs are considered adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria.. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal.	**(5) Monitoring and Trending:** Documentation and comparison of successive inspection results is needed to perform meaningful trending. An appropriate inspection schedule should be established to provide reasonable assurance that adequate monitoring and trending will be accomplished under the MR Structure Monitoring Program. **(6) Acceptance Criteria:** Acceptance criteria, against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. These criteria are defined on a licensee-specific basis. The acceptance criteria should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the acceptance criteria utilized in its MR Structures Monitoring Program will provide for timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. **(7) Corrective Actions:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Corrective Action requirement of Criterion 7 is satisfied. **(8) Confirmation Process:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Confirmation requirement of Criterion 8 is satisfied. **(9) Administrative Controls:** Provided the MR Structures Monitoring Program is conducted under 10CFR50 Appendix B (Quality Assurance), the Administrative Controls requirement of Criterion 9 is satisfied. **(10) Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation which threatens intended functions have only recently been implemented. At this time, it appears that MR Structures Monitoring should be an effective program, provided the details of licensee-specific programs adequately address Criteria 1, 3, 4, and 6.	
Generic Letter 88-05 "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988 mandates that PWR licensees monitor the condition of the reactor coolant pressure boundary for occurrences of borated water leakage. Periodic Visual Inspection of adjacent structures, components and supports for evidence of leakage and corrosion should be an element of the applicant's 88-05 monitoring program.	***(1) Scope of Program:*** The primary coolant pressure boundary of PWR's, containing borated water, must be monitored for early detection of small leaks, in order to prevent significant loss of material from boric acid corrosion. Early detection and correction of leakage should protect adjacent structural elements (e.g., supports) from boric acid corrosion. ***(2) Preventative Action:*** This is primarily a monitoring program, in addition to any regular preventive maintenance. ***(3) Parameters Monitored/Inspected:*** The required program includes 1) identification of locations where leaks smaller than technical specification limits can cause degradation of the pressure boundary by boric acid corrosion, and 2) development and implementation of procedures for locating small coolant leaks.	No, provided visual inspection of adjacent areas is included in applicant's program. Otherwise, plant-specific evaluation will be required.

III. STRUCTURES AND COMPONENTS SUPPORTS

B4 Supports for Miscellaneous Mechanical Equipment (e.g., Cranes, EDG, HVAC System Components)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B4.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Crack initiation and Growth	Fatigue	*Same as B4.1, Loss of material due to Environ-mental Corrosion*
B4.2	All	Vibration isolation elements	Non-metallic/ rubber	Inside contain-ment/ Outside contain-ment	Reduc-tion/ Loss of isolation function	Radiation Hardening, Temper-ature, humidity, sustained vibratory loading	*Same as B4.1, Loss of material due to Environ-mental Corrosion*
B4.3	All	Building concrete surround-ing anchor bolts; Grout pads	Reinforced concrete, grout, masonry	Inside contain-ment/ Outside contain-ment	Reduction in concrete anchor capacity	Concrete degradation due to vibratory loads or other effects	*Same as B4.1, Loss of material due to Environ-mental Corrosion*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
	(4) Detection: The mandated monitoring program includes methods for conducting examinations to detect leakage. Engineering evaluations are then performed to establish the impact on the reactor coolant pressure boundary when leakage is located. ***(5) Monitoring and Trending:*** No monitoring or trending activities for assessing the impact of boric acid corrosion on carbon steel reactor pressure boundary components in PWR plants are required by this monitoring program. ***(6) Acceptance Criteria:*** No acceptance criteria are specified by NRC monitoring program. Methods must be capable of detecting leaks smaller then technical specification limits. ***(7) Corrective Action:*** Corrective actions are taken to prevent recurrence of this type of corrosion. This includes modifications in design and operating procedures as necessary to reduce the probability of primary coolant leaks and the use of suitable corrosion resistant materials or the application of protective coatings/claddings. ***(8) Confirmation Process:*** Licenses were required to respond to GL 88-05 within 60 days providing assurances that the mandated program was in place or to be promptly implemented. ***(9) Administrative Control:*** The Licensees shall maintain records of the programs and results obtained . ***(10) Operating Experience:*** Objective evidence indicates that boric acid corrosion of steel supports and other structural elements is adequately managed by the existing program.	
Same as B4.1, Loss of material due to Environmental Corrosion	*Same as B4.1, Loss of material due to Environmental Corrosion*	*Same as B4.1, Loss of material due to Environ-mental Corrosion*
Same as B4.1, Loss of material due to Environmental Corrosion	*Same as B4.1, Loss of material due to Environmental Corrosion*	*Same as B4.1, Loss of material due to Environ-mental Corrosion*
Same as B4.1, Loss of material due to Environmental Corrosion	*Same as B4.1, Loss of material due to Environmental Corrosion*	*Same as B4.1, Loss of material due to Environ-mental Corrosion*

B5. Supports for Miscellaneous Steel Structures (e.g., Platforms, Pipe Whip Restraints, Jet Impingement Shields)

B5.1 Support Members; Anchor Bolts; Welds

B5.2 Building Concrete Surrounding Anchor Bolts; Grout Pads

B5. Supports for Miscellaneous Steel Structures (e.g., Platforms, Pipe Whip Restraints, Jet Impingement Shields)

Systems, Structures, and Components

Review Table III B5 addresses supports/anchorage for miscellaneous steel structures. Component supports are not specifically addressed in the draft Standard Review Plan for License Renewal (SRP-LR). Regions of interest and applicable aging effects are identified in the Table. The aging management review is presented for each region of interest /aging effect combination.

System Interfaces

Physical interfaces exist with the structure, system or component being supported and with the building structural element to which the support is anchored. The primary functional interface is to ensure adequate anchorage of the supported element during internal/external design basis events, so that the supported element can perform its intended function.

III. STRUCTURES AND COMPONENT SUPPORTS

B5 Supports for Miscellaneous Steel Structures (e.g., Platforms, Pipe Whip Restraints, Jet Impingement Shields)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B5.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside contain-ment/ Outside contain-ment	Loss of Material	Environ-mental Corrosion	10CFR50.65 NUMARC 93-01, Revision 2 Regulatory Guide 1.160 (formerly Draft DG-1051)

III. STRUCTURES AND COMPONENT SUPPORTS
B5 Supports for Miscellaneous Steel Structures (e.g., Platforms, Pipe Whip Restraints, Jet Impingement Shields)

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Maintenance Rule (10CFR50.65) -Structures monitoring The "Maintenance Rule" is intended to monitor the effectiveness of maintenance activities in nuclear power plants. It focuses on the adequacy of preventive and corrective maintenance activities. 10CFR50.65 requires each licensee to develop and implement a program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The nuclear power industry, through the Nuclear Energy Institute (NEI), has developed guidance for the development of such programs. Rev. 2 to NUMARC 93-01 was issued in April 1996. USNRC Regulatory Guide 1.160, Rev. 2, issued in March 1997, identifies this document as an acceptable approach to meeting the objectives of 10CFR50.65. Revision 2 to NUMARC 93-01 added Section 10.2.3, "Monitoring the Condition of Structures." It emphasizes the importance of monitoring the condition of plant structures. Quoting from this report, "Monitoring the condition of structures, like systems and components, should be predictive in nature and provide early warning of degradation. The baseline condition of plant structures should be established to facilitate condition monitoring activities." Regulatory Position 1.5 "Monitoring of Structures" in RG1.160, Rev. 2, states that the Maintenance Rule does not treat structures differently from systems and components. The attributes of an acceptable structure monitoring program are discussed. Structures Monitoring Programs developed to meet the requirements of 10CFR50.65 (Maintenance Rule) can be credited for addressing aging management of structures and structural components to meet the requirements of 10CFR54 (License Renewal). License	An applicant for License Renewal may reference its Structures Monitoring Program developed to meet the requirements of the Maintenance Rule (10CFR50.65), as further defined and clarified by NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Revision 2. The guidelines contained in these documents provide an adequate foundation for formulating licensee-specific MR Structures Monitoring Programs. An applicant for License Renewal should confirm that its MR Structures Monitoring Program adequately manages the effects of aging so that the intended functions of structures and component supports will be maintained, consistent with the current licensing basis, for the period of extended operation. The applicant should assess its MR Structures Monitoring Program against the attributes of an acceptable aging management program. Evaluation of MR Structures Monitoring against the ten (10) criteria for an acceptable aging management program follows: **(1)Scope of Program:** The MR Structures Monitoring Program scope is defined by the licensee; it may or may not encompass all structures and structural components which must be reviewed for License Renewal. The applicant should clearly identify the structure/aging effect/aging mechanism combinations which are managed by the MR Structures Monitoring Program. For potential structure/aging effect/aging mechanism combinations not covered by the MR Structures Monitoring Program, the applicant should justify that it is not significant for the applicant's plant, or identify the applicable aging management program. **(2) Preventive Actions:** Inspection and maintenance of protective coatings which inhibit corrosion of steel structural elements should be included as part of Structures Monitoring. No specific preventive actions are identified for other aging mechanisms. **(3) Parameters Monitored/Inspected:** For MR Structures Monitoring Programs, specification of the parameters monitored or inspected is the responsibility of the licensee. For License Renewal, the specific parameters monitored or inspected should be linked to degradation of intended function(s) and should detect the presence and extent of aging effects. The inspection scope should include bolt-tightness checks for concrete expansion anchors subjected to vibratory loads. The applicant should confirm that its specification of parameters to be monitored or inspected is consistent with meeting Criterion 3. **(4) Detection of Aging Effects:** Detection of aging effects before there is loss of intended function requires that periodic inspection be conducted, utilizing appropriate inspection methods implemented by qualified inspectors. Under the Maintenance Rule, the inspection schedule, inspection methods and inspector qualifications are defined by the individual licensees. An applicant for License Renewal should confirm that these elements of its MR Structures Monitoring Program are consistent with meeting Criterion 4.	No, if within the scope of the applicant's MR Structures Monitoring Program. Otherwise, justification for non-applicability or details of plant-specific program need to be evaluated.

III. STRUCTURES AND COMPONENT SUPPORTS

B5 Supports for Miscellaneous Steel Structures (e.g., Platforms, Pipe Whip Restraints, Jet Impingement Shields)

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

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Renewal applicants are encouraged to take credit for existing programs. A well formulated and documented structures monitoring program, in accordance with the guidance provided in NUMARC 93-01, Revision 2; and Regulatory Guide 1.160, Revision 2, should satisfy the requirements for an acceptable aging management program for License Renewal, when evaluated against the ten (10) criteria defined in Section 3.0 of the Draft SRP for License Renewal. The Calvert Cliffs and Oconee License Renewal applications do not directly take credit for structures monitoring under the Maintenance Rule. Plant-specific structures monitoring programs are identified and described, to demonstrate that adequate aging management programs are in place for structures and structural components. These programs were evaluated by the staff against the ten (10) criteria for an acceptable aging management program, defined in Section 3.0 of the Draft SRP-LR. For the most part, these programs are considered adequate. Specific open and confirmatory items are identified where these programs fall short of completely satisfying the ten criteria.. Prospective applicants for License Renewal may review the Calvert Cliffs and Oconee applications/SERs, for examples of structures monitoring programs which were credited for License Renewal.	**(5) Monitoring and Trending:** Documentation and comparison of successive inspection results is needed to perform meaningful trending. An appropriate inspection schedule should be established to provide reasonable assurance that adequate monitoring and trending will be accomplished under the MR Structure Monitoring Program. **(6) Acceptance Criteria:** Acceptance criteria, against which the need for corrective action is evaluated, are not specified in the MR or its implementing documents. These criteria are defined on a licensee-specific basis. The acceptance criteria should be consistent with existing applicable codes and standards and/or good engineering practice. The applicant for License Renewal should confirm that the acceptance criteria utilized in its MR Structures Monitoring Program will provide for timely corrective action prior to loss of intended function and are consistent with meeting Criterion 6. **(7) Corrective Actions:** Provided the MR Structures Monitoring Program is conducted under 10 CFR 50, Appendix B (Quality Assurance), the Confirmation requirement of Criterion 8 is satisfied. **(9) Administrative Controls:** Provided the MR Structures Monitoring Program is conducted under 10CFR50 Appendix B (Quality Assurance), the Administrative Controls requirement of Criterion 9 is satisfied. **(9) Administrative Controls:** Provided the MR Structures Monitoring Program is conducted under 10CFR50 Appendix B (Quality Assurance), the Administrative Controls requirement of Criterion 9 is satisfied. **(10) Operating Experience:** MR Structures Monitoring Programs to detect and correct aging degradation which threatens intended functions have only recently been implemented. At this time, it appears that MR Structures Monitoring should be an effective program, provided the details of licensee-specific programs adequately address Criteria 1, 3, 4, and 6.	

III. STRUCTURES AND COMPONENT SUPPORTS

B5 Supports for Miscellaneous Steel Structures (e.g., Platforms, Pipe Whip Restraints, Jet Impingement Shields)

Item	Structure/ Component	Region of Interest	Material	Environ-ment	Aging Effect	Aging Mechanism	References
B5.1	All	Support members; Anchor bolts; Welds	Carbon Steel	Inside PWR contain-ment	Loss of Material	Boric Acid Corrosion	NRC GL 88-05 IE Bulletin 82-02 IE IN 80-27 IE IN 86-108 Supplements 1,2, and 3
B5.2	All	Building concrete surround-ing anchor bolts; Grout pads	Reinforced concrete, grout, masonry	Inside contain-ment/ Outside contain-ment	Reduction in concrete anchor capacity	Concrete degradation	*Same as B5.1, Loss of material due to Environ-mental Corrosion*

Existing Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Generic Letter 88-05 "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988 mandates that PWR licensees monitor the condition of the reactor coolant pressure boundary for occurrences of borated water leakage. Periodic Visual Inspection of adjacent structures, components and supports for evidence of leakage and corrosion should be an element of the applicant's 88-05 monitoring program.	***(1) Scope of Program:*** The primary coolant pressure boundary of PWR's, containing borated water, must be monitored for early detection of small leaks, in order to prevent significant loss of material from boric acid corrosion. Early detection and correction of leakage should protect adjacent structural elements (e.g., supports) from boric acid corrosion. ***(2) Preventative Action:*** This is primarily a monitoring program, in addition to any regular preventive maintenance. ***(3) Parameters Monitored/Inspected:*** The required program includes 1) identification of locations where leaks smaller than technical specification limits can cause degradation of the pressure boundary by boric acid corrosion, and 2) development and implementation of procedures for locating small coolant leaks. ***(4) Detection:*** The mandated monitoring program includes methods for conducting examinations to detect leakage. Engineering evaluations are then performed to establish the impact on the reactor coolant pressure boundary when leakage is located. ***(5) Monitoring and Trending:*** No monitoring or trending activities for assessing the impact of boric acid corrosion on carbon steel reactor pressure boundary components in PWR plants are required by this monitoring program. ***(6) Acceptance Criteria:*** No acceptance criteria are specified by NRC monitoring program. Methods must be capable of detecting leaks smaller then technical specification limits. ***(7) Corrective Action:*** Corrective actions are taken to prevent recurrence of this type of corrosion. This includes modifications in design and operating procedures as necessary to reduce the probability of primary coolant leaks and the use of suitable corrosion resistant materials or the application of protective coatings/claddings. ***(8) Confirmation Process:*** Licenses were required to respond to GL 88-05 within 60 days providing assurances that the mandated program was in place or to be promptly implemented. ***(9) Administrative Control:*** The Licensees shall maintain records of the programs and results obtained . ***(10) Operating Experience:*** Objective evidence indicates that boric acid corrosion of steel supports and other structural elements is adequately managed by the existing program.	No, provided visual inspection of adjacent areas is included in applicant's program. Otherwise, plant-specific evaluation will be required.
Same as B5.1, Loss of material due to Environmental Corrosion	*Same as B5.1, Loss of material due to Environmental Corrosion*	*Same as B5.1, Loss of material due to Environmental Corrosion*

References

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

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

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

American Society of Mechanical Engineers, ASME Section III, *Rules for Construction of Nuclear Power Plant Components,* Division 1 - Subsection NF, *Component Supports.* The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.

American Society of Mechanical Engineers, ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components,* Subsection IWF, *Requirements for Class 1, 2, 3, and MC Component Supports of Light-Water Cooled Power Plants,* 1989 Edition. The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.

American Society of Testing and Materials, ASTM C33-90, "Standard Specification for Concrete Aggregates."

American Society of Testing and Materials, ASTM C227-50, "Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)."

American Society of Testing and Materials, ASTM C295-54, "Guide for Petrographic Examination of Aggregates (Chemical Method)."

Code of Federal Regulations: 10CFR50.55a, "Codes and Standards"

Code of Federal Regulations: 10CFR50.65 "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," Vol. 1 & 2, April 1988.

IE Bulletin 74-03, "Failure of Structural or Seismic Support Bolts on Class I Components," April 29, 1974.

IE Bulletin 82-02, "Degradation of Threaded Fasteners in the Reactor Coolant Pressure Boundary of PWR Plants," June 2, 1982.

IE Bulletin 80-11, "Masonry Wall Design," May 8, 1980.

IE Information Notice 80-27, "Degradation of Reactor Coolant Pump Studs," June 11, 1980.

IE Information Notice 86-108, "Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion," December 29, 1986; Supplement 1, April 20, 1987; Supplement 2, November 1987; Supplement 3, January 1995.

IE Information Notice 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11," December 31, 1987.

NRC Information Notice 97-11, "Cement Erosion from Containment Subfoundations at Nuclear Power Plants," March 21, 1997.

NRC Information Notice 98-26, "Settlement Monitoring and Inspection of Plant Structures Affected by Degradation of Porous Concrete Subfoundations," July 24, 1998.

NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary," March 17, 1988.

NRC Generic Letter 91-17, Generic Safety Issue 29, "Bolting Degradation in Nuclear Power Plants," October 17, 1991.

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

NRC Regulatory Guide 1.160: "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, March 1997.

NUMARC 93-01, Revision 2: "Nuclear Energy Institute - Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants [Line-In/Line-Out Version]" April 1996.

NUREG-1339, "Resolution of Generic Safety Issue29: Bolting in Nuclear Power Plants," June 1990.

NUREG-1557, "Summary of Technical Information and Agreements from Nuclear Management and Resources Council Industry Reports Addressing License Renewal," October 1996.