UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 24, 2000

Mr. Douglas J. Walters
Nuclear Energy Institute
1776 I Street, NW., Suite 400
Washington, DC 20006-3708

Mr. David Lochbaum
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1616 P. St., NW, Suite 310
Washington, DC 20036-1495

SUBJECT: DRAFT STANDARD REVIEW PLAN FOR LICENSE RENEWAL

Gentlemen:

We are revising the draft Standard Review Plan for License Renewal (SRP-LR). As discussed in the public workshop on December 6, 1999, we have been publicly releasing early drafts of various sections of this document to invite stakeholders participation. Specifically, we have provided some sections by letters to the Nuclear Energy Institute (NEI), dated March 6 and March 20, 2000, that are available in the NRC's Public Document Room (PDR). We have since completed an early draft of the entire document. We are forwarding this draft document for your information. Each of you has agreed to serve as a focal point for renewal interests and issues for the industry and public interest groups, respectively. Therefore, we request that you inform interested parties that the revised draft of the SRP-LR is available.

The enclosed draft SRP-LR is based on the information in the draft "Generic Aging Lessons Learned" (GALL) report, dated December 6, 1999, which was made publicly available at the December 6, 1999, license renewal workshop and in the PDR. As we develop the draft GALL report further, by addressing stakeholders' comments, we will be revising the draft SRP-LR accordingly.

We are seeking preliminary feedback on the draft SRP-LR from all interested stakeholders, in preparation for issuing the SRP-LR for formal public comments in August 2000, in accordance with the plan described during the workshop. If you have any questions regarding this matter, please contact Sam Lee at (301) 415-3109.

Sincerely,

CIGrimes

Christopher I. Grimes, Chief
License Renewal and Standardization Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Project No. 690

Enclosure: As stated

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/RA/

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Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants

Draft

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

Draft - April 21, 2000

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INTRODUCTION

The Standard Review Plan for License Renewal (SRP-LR) is prepared for the guidance of staff reviewers in the Office of Nuclear Reactor Regulation in performing safety reviews of applications to renew licenses of nuclear power plants in accordance with 10 CFR Part 54. The principal purposes of the SRP-LR are to assure the quality and uniformity of staff reviews and to present a well-defined base from which to evaluate applicant programs and activities for the period of extended operation. It is also a purpose of the SRP-LR to make information about regulatory matters widely available and to improve communication and understanding of the staff review process by interested members of the public and the nuclear power industry.

The safety review is primarily based on the information provided by an applicant in a license renewal application. 10 CFR 54.21 of the Commission's regulations requires that each application for a renewal license for a nuclear facility shall include an integrated plant assessment (IPA), current licensing basis (CLB) changes during NRC review of the application, an evaluation of time-limited aging analyses (TLAAs), and a final safety analysis report (FSAR) supplement. In addition to technical information required by 10 CFR 54.21, an application for license renewal must contain general information (10 CFR 54.19), necessary technical specification changes (10 CFR 54.22), and environmental information (10 CFR 54.23). The license renewal application must be sufficiently detailed to permit the staff to determine whether the effects of aging will be managed such that the plant can be operated during the period of extended operation without undue risk to health and safety of the public. Prior to submission of a license renewal application, an applicant should have analyzed the management of aging effects in sufficient detail to conclude that the plant can be operated safely during the period of extended operation. The license renewal application is the principal document in which the applicant provides the information needed to understand the basis upon which this conclusion has been reached.

10 CFR 54.21 specifies, in general terms, the information to be supplied in the license renewal application. Draft Regulatory Guide DG-xxxx, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," proposes to endorse the Nuclear Energy Institute (NEI) document NEI 95-10, Rev. x, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule." NEI 95-10 provides guidance on the format and content of a license renewal application. The SRP-LR sections are keyed to the Standard Format, and the SRP-LR sections are numbered according to the section numbers in the Standard Format.

During the staff review of the initial license renewal applications, the staff and the applicants have found that most of the aging management programs for license renewal are existing programs. Thus, NEI raised the "credit for existing programs" issue: 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? 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. By a staff requirements memorandum (SRM) dated August 27, 1999, the Commission approved the staff recommendation and directed the staff to focus the staff review guidance in the SRP-LR on areas where existing programs should be augmented for license renewal. The SRP-LR would reference a "Generic Aging Lessons Learned" (GALL) report which evaluates existing programs generically to document the basis for determining when existing programs are adequate without

change and when existing programs should be augmented for license renewal. The GALL report (NUREG-xxxx) should be treated in the same manner as an approved topical report. The staff should not repeat its review of the matters described in the GALL report and should find it acceptable when the GALL report is referenced in a license renewal application. However, the staff should ensure that the material presented in the GALL report is applicable to the specific plant involved. The staff should also verify that the applicant has identified specific programs as described and evaluated in the GALL report if they are relied on for license renewal.

The SRP-LR is divided into four major chapters: 1. Administrative Information; 2. Structures and Components Subject to Aging Management Review; 3. Aging Management Review Results; and 4. Time-Limited Aging Analyses. It also has an appendix containing branch technical positions. The SRP-LR is written to cover various site conditions and plant designs and to provide complete procedures for all of the areas of review pertinent to each of the SRP-LR sections. For any specific application, staff reviewers may select and emphasize particular aspects of each SRP-LR section as appropriate for the application. In some cases, the major portion of the review of a plant program or activity may be done on a generic basis with the owners group of that plant type rather than in the context of reviews of particular applications from utilities. In other cases a plant program or activity may be sufficiently similar to that of a previous plant so that a complete review of the program or activity is not needed. For these and other similar reasons, the staff may not carry out in detail all of the review steps listed in each SRP-LR section in the review of every application.

The individual SRP-LR sections address who performs the review, the matters that are reviewed, the basis for review, how the review is accomplished, and the conclusions that are sought. One of the objectives of the SRP-LR is to assign review responsibilities to the appropriate NRR branches. Each SRP-LR section identifies the branch that has the primary review responsibility for that section. In some review areas, the primary branch may require support, and the branches that are assigned these secondary review responsibilities are also identified for each SRP-LR section.

Each SRP-LR section is organized into six subsections, consistent with NUREG-0800, as follows:

1. **Areas of Review**

   This subsection describes the scope of review, that is, what is being reviewed by the branch having primary review responsibility. This subsection contains a description of the systems, structures, components, analyses, data, or other information that is reviewed as part of the license renewal application. It also contains a discussion of the information needed or the review expected from other branches to permit the primary review branch to complete its review.

2. **Acceptance Criteria**

   This subsection contains a statement of the purpose of the review, an identification of which NRC requirements are applicable, and the technical basis for determining the acceptability of programs and activities within the area of review of the SRP-LR section. The technical bases consist of specific criteria such as NRC Regulatory Guides, Codes and Standards, Branch Technical Positions, and other criteria.

Consistent with the approach in NUREG-0800,"Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (July 1981), the technical bases for some sections of the SRP-LR can be provided in Branch Technical Positions or Appendices as they are developed and be included in the SRP-LR.

3. Review Procedures

This subsection discusses how the review is accomplished. The section is generally a step-by-step procedure that the reviewer goes through to provide reasonable verification that the applicable acceptance criteria have been met.

4. Evaluation Findings

This subsection presents the type of conclusion that is sought for the particular review area. For each section, a conclusion of this type is included in the staff's safety evaluation report (SER) in which the staff publishes the results of its review. The SER also contains a description of the review including such subjects as which aspects of the review were selected or emphasized; which matters were modified by the applicant, require additional information, will be resolved in the future, or remain unresolved; where the applicant's program deviates from the criteria stated in the SRP-LR; and the bases for any deviations from the SRP-LR or exemptions from the regulations.

5. Implementation

This subsection discusses the NRC staff's plans for using the SRP-LR section.

6. References

This subsection lists the references used in the review process.

This SRP-LR incorporated the staff experience from the review of the initial license renewal applications. The SRP-LR may be considered a part of a continuing regulatory framework development activity that documents current methods of review and provides a basis for orderly modifications of the review process in the future. The SRP-LR will be revised and updated periodically as the need arises to incorporate experience gained during future reviews, to clarify the content or correct errors, to reflect changes in relevant regulations, and to incorporate modifications approved by the Director of the Office of Nuclear Reactor Regulation. A revision number and publication date are printed at a lower corner of each page of each SRP-LR section. Since individual sections will be revised as needed, the revision numbers and dates will not be the same for all sections. The table of contents indicates the revision numbers of the currently effective sections. Comments and suggestions for improvement should be sent to the Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Notices of errors or omissions should also be sent to the same address.

1.1 DOCKETING OF TIMELY AND SUFFICIENT RENEWAL APPLICATION

Review Responsibilities

Primary - Branch responsible for license renewal projects
Secondary - Branch responsible for environmental review, and
Branches responsible for technical review, as appropriate

1.1.1 Areas of Review

This review plan section addresses the review of the acceptability of a license renewal application for docketing in accordance with 10 CFR 2.101 and whether a license renewal application is timely and sufficient in order to allow the provisions of 10 CFR 2.109(b) to apply. 10 CFR 2.109(b) was written to comply with the Administrative Procedures Act. Allowing 10 CFR 2.109(b) to apply to the application means that the current license will not expire until the NRC makes a final determination on the license renewal application.

It is important to note that this review is not a detailed in-depth review of the technical aspects of the application. Docketing of a timely and sufficient renewal application does not preclude requesting additional information as the review proceeds; nor does it predict the NRC's final determination regarding the acceptance or rejection of the renewal application. It is also important to note that a plant's current license will not expire after the passing of the license's expiration date if a timely and sufficient renewal application has been docketed. During this time until the renewal application has been finally determined by the NRC, the licensee must continue to comply with its licensing basis, including all applicable license conditions, orders, and rules and regulations.

The following areas relating to the license renewal application are reviewed:

1.1.1.1 Docketing/Sufficiency of Application

The license renewal application is reviewed for acceptability for docketing as a sufficient application in accordance with 10 CFR 2.101 and 10 CFR 2.109(b).

1.1.1.2 Timeliness of Application

The timeliness of a license renewal application is reviewed for applicability of 10 CFR 2.109(b) and 54.17(c).

1.1.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 2.101 and 10 CFR 2.109(b).

1.1.2.1 Docketing/Sufficiency of Application

It is enough that the licensee submits the required reports, analysis, and other documents required in such application (56 FR 64923). The same acceptance criteria apply to the docketing acceptance review of 10 CFR 2.101(a)(2).

1.1.2.2 Timeliness of Application

A sufficient license renewal application is timely if it is submitted at least 5 years, but not more than 20 years, before the expiration of the current operating license.

1.1.3 Review Procedures

A licensee may choose to submit plant-specific reports addressing portions of the license renewal rule requirements for NRC review and approval prior to submitting a renewal application. An applicant may incorporate by reference these reports or other information contained in previous applications for licenses or license amendments, statements, or correspondence filed with the Commission, provided that the references are clear and specific. However, the final determination of the docketing of a timely and sufficient renewal application is made only after a formal renewal application has been tendered to the NRC.

For each area of review, the following review procedures are to be followed:

1.1.3.1 Docketing/Sufficiency of Application

Upon receipt of a tendered application for license renewal, the reviewer should determine whether the applicant has made a reasonable effort to provide the administrative, technical, and environmental information. Draft Regulatory Guide DG-1047, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses" (Ref. 1), was issued for public comment on August 26, 1996 (61 FR 43792). DG-1047 provides draft guidance on the format and content of a renewal application. The reviewer should use the review checklist in Table 1.1-1 of this review plan section to determine whether the application is reasonably complete and conforms to the requirements in 10 CFR Part 54.

Items I.1 through I.10 in the checklist address administrative information and, for the purpose of this docketing/sufficiency review, the reviewer should check the "Yes" column if the information is included in the application. Item II in the checklist addresses timeliness of the application.

Items III.1 through III.4 and Item IV in the checklist address technical information and technical specification changes. The reviewer may consult Chapters 2 through 4 of this standard review plan for information regarding a technical review. Although the purpose of this docketing/sufficiency review is not to determine the technical adequacy of the application, the reviewer should determine whether the applicant has provided reasonably complete information in the application to address the renewal rule requirements. The reviewer may request assistance from appropriate technical review branches to determine whether the application is reasonable in addressing the items in the checklist such that there is sufficient information in the application for the staff to begin its technical review. The reviewer would check the "Yes"

column for a checklist item if the applicant has provided reasonably complete information in the application to address the checklist item.

Item V in the checklist addresses environmental information. The environmental review staff should review the supplement to the environmental report in accordance with the guidelines in Draft Regulatory Guide DG-4005, "Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses" (Ref. 2), which is the draft environmental regulatory guide for 10 CFR Part 51. The reviewer would check the "Yes" column if the staff in the branch responsible for environmental review determines that the renewal application contains information consistent with the guidelines in the draft environmental regulatory guide. The NRC staff review and the NRC staff preparation of the supplemental environmental impact statement will be guided by Supplement 1, "Operating License Renewal for Nuclear Plants," to NUREG-1555 (Ref. 3).

The application should address each item in the checklist for it to be a reasonably complete and sufficient application. If the reviewer determines that an item in the checklist is not applicable, the reviewer should include a brief statement that the item is not applicable and provide the basis for the statement.

If information in the application for a checklist item is either not provided or not reasonably complete and no justification is provided, the reviewer would check the "No" column for that checklist item. By checking the "No" column for any checklist item in Table 1.1-1, except as discussed in Subsection 1.1.3.2 of this review plan section, the reviewer indicates that the application is not acceptable for docketing as a sufficient renewal application, unless the applicant modifies the application to provide the specific information.

If the staff determines that the application is not acceptable for docketing as a sufficient application, the staff's letter to the applicant should clearly state that the application is not sufficient and is not acceptable for docketing, and that the provisions in 10 CFR 2.109(b) are not satisfied and the current license will expire at its expiration date. Further, the staff should discuss the deficiencies found in the application and offer an opportunity for the applicant to modify its application to provide the specific information. The staff would review the modified application, when submitted, to determine whether it is acceptable for docketing as a sufficient application.

If the reviewer is able to answer "Yes" to the applicable items in the checklist, the application is acceptable for docketing as a timely and sufficient renewal application. Therefore, the provisions of 10 CFR 2.109(b) are satisfied and the current license will not expire until the NRC makes a final determination on the renewal application. The staff would issue a letter to the applicant documenting the staff's determination that the application is acceptable for docketing as a timely and sufficient renewal application. Normally, this letter should be issued within 30 days of receipt of a renewal application. A notice of acceptance for docketing of the application and notice of opportunity for a hearing regarding renewal of licenses would then be published in the Federal Register.

If the staff determines that the application is acceptable for docketing as a sufficient application, the staff would begin its technical review. For license renewal applications, the NRC intends to

maintain the docket number of the operating license in effect to ensure continuation of the requirements in the current licensing basis (CLB).

1.1.3.2 Timeliness of Application

Upon receipt of a tendered application for license renewal, the reviewer performs a docketing/sufficiency review, as discussed in Subsection 1.1.3.1 of this review plan section. If the reviewer determines that the application is acceptable for docketing as a sufficient application, the reviewer should determine whether this application is submitted in a timely manner to meet the provisions of 10 CFR 2.109(b).

If the sufficient application is submitted at least 5 years before the expiration of the current operating license, the reviewer would check the "Yes" column in Item II in the checklist in Table 1.1-1. If an applicant has to modify its application, as discussed in Subsection 1.1.3.1 of this review plan section, before the staff can find the application acceptable for docketing as a sufficient application, the modified application should be submitted at least 5 years before the expiration of the current operating license.

If the reviewer checks the "No" column in Item II in the checklist indicating that a sufficient renewal application is not submitted at least 5 years before the expiration of the current operating license, the staff's letter to the applicant should clearly state that the application is not timely and that the provisions in 10 CFR 2.109(b) are not satisfied and the current license will expire at its expiration date. However, if the application is otherwise determined to be acceptable for docketing, the staff technical review would continue.

1.1.4 Evaluation Findings

The reviewer determines if sufficient and adequate information has been provided to satisfy the provisions of this review plan section. Depending on the results of this review, one of the following conclusions is included in the staff's letter to the applicant:

> The NRC staff has determined that the applicant has submitted sufficient information that is complete and acceptable for docketing, in accordance with 10 CFR 54.19, 54.21, 54.22, 54.23, and 51.53(c). However, the staff's acceptance and sufficiency determination does not preclude request for additional information as the review proceeds.
>
> The application is not acceptable for docketing as a timely and sufficient renewal application.

1.1.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

1.1.6 References

1. Draft Regulatory Guide DG-1047, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," August 1996.

2. Draft Regulatory Guide DG-4005, "Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses," July 1998.

3. Draft Regulatory Guide DG-1555, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants," July 1997.

Table 1.1-1. Acceptance Review Checklist for Docketing of Timely and Sufficient Renewal Application

		Yes	No
I.	**General Information**		
1.	Application identifies specific unit(s) applying for license renewal	___	___
2.	Filing of renewal application [10 CFR 54.17(a)] is in accordance with:		
	A. 10 CFR Part 2, Subpart A		
	a. 10 CFR 2.101	___	___
	b. 10 CFR 2.109(b)	___	___
	B. 10 CFR 50.4		
	a. The application is addressed to the Document Control Desk as specified in 10 CFR 50.4(a)	___	___
	b. The signed original application and 13 copies are provided to the Document Control Desk. One copy provided to the appropriate Regional office [10 CFR 50.4(b)(3)]	___	___
	c. Verify that the form of the application meets the requirements of 10 CFR 50.4(c)	___	___
	C. 10 CFR 50.30		
	Application filed in accordance with 10 CFR 50.4 [10 CFR 50.30(a)(1)]	___	___
	Application submitted under oath or affirmation [10 CFR 50.30(b)]	___	___
3.	Applicant is eligible to apply for a license, and is not a foreign-owned or foreign-controlled entity [10 CFR 54.17(b)]	___	___
4.	Application is not submitted earlier than 20 years before expiration of current license [10 CFR 54.17(c)]	___	___
5.	Renewal application states whether it contains		

applications for other kinds of licenses [10 CFR 54.17(d)] ___ ___

6. Information incorporated by reference in the application is contained in other documents previously filed with the Commission, and the references are clear and specific [10 CFR 54.17(e)] ___ ___

7. Restricted data agreement is present and complies with 10 CFR 50.33(j) [10 CFR 54.17(f)] ___ ___

8. Written agreement on the accessibility of restricted data is provided [10 CFR 54.17(g)] ___ ___

9. Information specified in 10 CFR 50.33(a) through (e), (h), and (i) is provided or referenced [10 CFR 54.19(a)]:

   A. Name of applicant ___ ___

   B. Address of applicant ___ ___

   C. Business description ___ ___

   D. Citizenship and ownership details ___ ___

   E. License information ___ ___

   F. Construction or alteration dates ___ ___

   G. Regulatory agencies and local publications ___ ___

10. Conforming changes have been submitted to the standard indemnity agreement (10 CFR 140.92, Appendix B) to account for the proposed change in the expiration date [10 CFR 54.19(b)] ___ ___

II. Timeliness Provision

Sufficient application is submitted greater than 5 years before expiration of current license [10 CFR 2.109(b). If not, application can be accepted for docketing but timely renewal provision in 10 CFR 2.109(b) does not apply ___ ___

III. Technical Information

1. An integrated plant assessment [10 CFR 54.21(a)] consists of:

   A. For those systems, structures, and components within the scope of license renewal [10 CFR 54.4], identification and listing of those structures and components that are subject to aging management review in accordance with 10 CFR 54.21(a)(1)(i) and (ii)

      a. Description of the boundary of the system or structure considered (if applicant initially scoped at the system or structure level). Within this boundary, identification of structures and components subject to aging management review. For commodity groups, description of basis for the grouping ___ ___

      b. Lists of structures, and components subject to an aging management review ___ ___

   B. Description and justification of method used to identify structures and components subject to aging management review [10 CFR 54.21(a)(2)] ___ ___

   C. Demonstration that the effects of aging will be adequately managed for each structure and component identified, so that their intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation [10 CFR 54.21(a)(3)]

      a. Description of the structure and component intended function(s). ___ ___

      b. Identification of applicable aging effects based on materials, environment, operating experience, etc. ___ ___

      c. Aging management programs are identified and described ___ ___

      d. Demonstration of aging management provided ___ ___

2. An evaluation of time-limited aging analyses (TLAAs) [10 CFR 54.21(c)] consists of:

A. Listing of plant-specific TLAAs in accordance with the six criteria specified in 10 CFR 54.3 [10 CFR 54.21(c)(1)] ___ ___

B. An evaluation of each identified TLAA using one of the three approaches specified in 10 CFR 54.21(c)(1)(i) to (iii) ___ ___

3. All plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on a TLAA are listed, and evaluations justifying the continuation of these exemptions for the period of extended operation are provided [10 CFR 54.21(c)(2)]

A. Listing of plant-specific exemptions that are based on TLAAs as defined in 10 CFR 54.3 [10 CFR 54.21(c)(2)] ___ ___

B. An evaluation of each identified exemption justifying the continuation of these exemptions for the period of extended operation [10 CFR 54.21(c)(2)] ___ ___

IV. A final safety analysis report (FSAR) supplement [10 CFR 54.21(d)] contains the following information:

1. Summary description of the aging management programs and activities for managing the effects of aging ___ ___

2. Summary description of the evaluation of TLAAs ___ ___

V. Technical Specification Changes

Any technical specification changes necessary to manage the aging effects during the period of extended operation and their justifications are included in the application [10 CFR 54.22] ___ ___

VI. Environmental Information

Application includes a supplement to the environmental report that is in accordance with the requirements of Subpart A of 10 CFR Part 51 [10 CFR 54.23] ___ ___

2.1 SCOPING AND SCREENING METHODOLOGY

Review Responsibilities

Primary - Branch responsible for quality assurance
Secondary - Branches responsible for systems, as appropriate

2.1.1 Areas of Review

This review plan section addresses the scoping and screening methodology for license renewal. As part of the integrated plant assessment specified in 10 CFR 54.21(a), an applicant is required by 10 CFR 54.21(a)(2) to describe and justify methods used to identify structures and components subject to an aging management review for license renewal. These are "passive," "long-lived" structures and components, as described in 10 CFR 54.21(a)(1), that are in systems, structures, and components (SSCs) within the scope of license renewal, as defined in 10 CFR 54.4(a). The identification of the systems, structures, and components within the scope of license renewal is called "scoping." For those systems, structures, and components within the scope of license renewal, the identification of "passive, "long-lived" structures and components that are subject to an aging management review is called "screening."

To verify that the applicant has properly implemented its methodology, the staff reviews the implementation results separately, following the guidance in Sections 2.2 through 2.5 of this standard review plan, to confirm that there is no omission of structures and components subject to an aging management review for license renewal.

The following areas relating to the applicant's scoping and screening methodology are reviewed:

2.1.1.1 Scoping

The methodology used by the applicant to implement the scoping requirements of 10 CFR 54.4, "Scope," is reviewed.

2.1.1.2 Screening

The methodology used by the applicant to implement the "screening" requirements of 10 CFR 54.21(a)(1) and (2) is reviewed.

2.1.2 Acceptance Criteria

The acceptance criteria for the areas of review are based on the following regulations:

- 10 CFR 54.4(a) as it relates to the identification of plant structures, systems, and components within the scope of the rule .
- 10 CFR 54.4(b) as it relates to the identification of the intended functions of plant systems and structures determined to be within scope of the rule.
- 10 CFR 54.21(a)(1) and (a)(2) as it relates to the methods utilized by the applicant to identify plant structures and components subject to aging management review.

Specific criteria necessary to meet the relevant requirements of §54.4(a), §54.4(b), §54.21(a)(1), and §54.21(a)(2) are as follows:

2.1.2.1 Scoping

The scoping methodology utilized by the applicant should be consistent with the process described in Section 3.0, "Identify the SSCs Within the Scope of License Renewal and Their Intended Functions," of NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Revision 1 (Ref. 1) or the justification provided by the applicant for any exceptions should be found to be acceptable by the reviewer.

2.1.2.2 Screening

The "screening" methodology utilized by the applicant should be consistent with the process described in Section 4.1, "Identification of Structures and Components Subject to an Aging Management Review and Intended Functions," of NEI 95-10, Revision 1.

2.1.3 Review Procedures

Preparation for the review of the scoping and screening methodology employed by the applicant should include the following:

1. Review of the Commission's Safety Evaluation Report that was issued upon receipt of the operating license for the facility. This review is conducted for the purpose of familiarization with the principal design criteria for the facility and its current licensing basis (CLB), as defined in §54.3(a).

2. Review of Chapters 1 through 12 of the Updated Final Safety Analysis Report (UFSAR) and the facility's technical specifications for the purposes of familiarization with the facility design and the nomenclature that is applied to structures, systems, and components within the facility (including the bases for such nomenclature). During this review, the structures, systems and components that are relied upon to remain functional during and after design bases events, as defined in §50.49(b)(1)(ii), for which the facility was designed to ensure that the functions described in §54.4(a)(1) are successfully accomplished should be identified. This review should also yield information regarding seismic Category I structures, systems, and components as defined in Regulatory Guide 1.29, "Seismic Design Classification" (Ref. 2). For a newer vintage plant, this information is typically contained in Section 3.2.1, "Seismic Classification," of the plant's UFSAR consistent with the Standard Review Plan (NUREG-0800) (Ref. 3).

3. Review of Chapter 15 (or equivalent) of the UFSAR to identify the anticipated operational occurrences and postulated accidents that are explicitly evaluated in the accident analysis for the facility. During this review, the structures, systems, and components that are relied upon to remain functional during and after design bases accidents for which the facility was designed to ensure that the functions described in §54.4(a)(1) are successfully accomplished should be identified. However, events such as fire, floods, storms, earthquakes, tornadoes, or hurricanes are not explicitly considered in the review of anticipated operational occurrences and postulated accidents in Chapter 15 of the UFSAR, even though their effect could result in potential offsite exposures comparable to the applicable guideline exposures set forth in §50.34(a)(1) or §100.11. Therefore, information

pertaining to these events and the structures, systems, and components relied upon to mitigate or cope with their effects will be found in other chapters of the UFSAR.

4. Review of the facility's Probabilistic Risk Analysis (PRA) Summary Report that was prepared by the licensee in response to Generic Letter (GL) 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities - 10 CFR 50.54(f)," dated November 23, 1988 (Ref. 4). This review should yield additional information regarding the impact of the Individual Plant Examination (IPE) on the CLB for the facility.

5. Review of the results of facility's Individual Plant Examination of External Events (IPEEE) study conducted as a follow-up to the IPE performed as a result of GL 88-20.

6. Review of the facility's CLB records to assess the impact of any NRC orders, exemptions, or license conditions on the classification of the facility's structures, systems, and components.

7. Review of the applicant's docketed correspondence related to the following regulations: (a) 10 CFR 50.48, "Fire Protection" (FP), (b) 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants" (EQ), 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events" (PTS), 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants" (ATWS), and 10 CFR 50.63, "Loss of All Alternating Current Power" SBO). PTS is only applicable to pressurized water reactor (PWR) plants and, as specified in the regulation, an evaluation in accordance with RG 1.154 (Ref. 5) for boiling water reactor (BWR) plants is not required.

2.1.3.1 Scoping

Once the information delineated above has been gathered, the reviewer reviews the applicant's methodology to determine whether its depth and breadth is sufficiently comprehensive to identify the systems, structures, and components within the scope of license renewal and the structures and components requiring an aging management review in a manner consistent with the facility's CLB. Because "[t]he CLB represents the evolving set of requirements and commitments for a specific plant that are modified as necessary over the life of a plant to ensure continuation of an adequate level of safety" (60 FR22465), the systems, structures and components that make up an applicant's current licensing basis (CLB) should be considered as the initial input into the scoping process. To determine the safety-related systems, structures and components that are required under 10 CFR 54.4 (a)(1), an applicant needs to identify those systems, structures and components that are relied upon to remain functional during and following a design-basis event, consistent with the CLB of the facility. §50.49 defines design-basis events as conditions of normal operation, including anticipated operational occurrences, design-basis accidents, external events and natural phenomena for which the plant must be designed.

Typically, events for which the plant must be designed include those functions, and the associated systems, structures, and components relied upon to fulfill the requirements of regulations, orders, license conditions, exemptions, and technical specifications. This includes all plant-specific design bases (as defined in §50.2, "Definitions.") information found throughout the UFSAR, and is not limited to the Accident Analysis Chapter of the UFSAR. Therefore, to fulfill the scoping requirement under 10 CFR 54.4(a)(1), an applicant needs to identify the

design basis events, the associated functions, and the resulting systems, structures, and components within its UFSAR, applicable NRC regulations, license conditions, Commission orders, and exemptions (that are in effect) that are relied upon to remain functional during and following design basis events for which the plant must be designed to ensure the functions under 10 CFR 54.4 (a)(1)(i), (ii), and (iii).

With respect to technical specifications, the Commission states (60 FR 22467) the following:

> "The Commission believes that there is sufficient experience with its policy on technical specifications to apply that policy generically in revising the license renewal rule consistent with the Commission's desire to credit existing regulatory programs. Therefore, the Commission concludes that the technical specification limiting conditions for operation scoping category is unwarranted and has deleted the requirement that identifies systems, structures, and components with operability requirements in technical specifications as being within the scope of the license renewal review."

Therefore, an applicant need not consider its technical specifications, and applicable limiting conditions of operation when scoping for license renewal. This is not to say that the events, functions and systems, structures, or components within the applicant's technical specifications can be excluded from the scope of license renewal solely based on its inclusion in the technical specifications. Those systems, structures, and components within an applicant's technical specifications that are relied upon to remain functional during a design basis event as identified within the applicant's UFSAR, applicable NRC regulations, license conditions, Commission orders, and exemptions may need to be included within the scope of license renewal.

For NRC bulletins, generic letters, enforcement actions, licensee commitments, staff safety evaluations, and license event reports that make up the remainder of an applicant's CLB, many of the associated systems, structures, and components need not be considered under license renewal. Generic communications, safety evaluations, and other documents found on the docket are not typically considered regulatory requirements, and commitments made by licensee to address any associated safety concerns are not typically considered design requirements. However, any generic communication, safety evaluation, or licensee commitment that specifically identifies or describes a function associated with a system(s), structure(s), and/or component(s) necessary to fulfill the requirement of a particular regulation, order, license condition, and/or exemption may need to be considered when scoping for license renewal. For example, NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," states the following:

> "The licensing basis according to 10 CFR 50.55a for all PWRs requires that the licensee meet the American Society of Mechanical Engineers Boiler and Pressure Vessel Code Sections III and XI and to reconcile the pipe stresses and fatigue evaluation when any significant differences are observed between measured data and the analytical results for the hypothesized conditions. Staff evaluation indicates that the thermal stratification phenomenon could occur in all PWR surge lines and may invalidate the analyses supporting the integrity of the surge line. The staff's concerns include unexpected bending and thermal striping (rapid oscillation of the thermal boundary interface along the piping inside surface) as they affect the overall integrity of the surge line for its design life (e.g., the increase of fatigue)."

Therefore, this bulletin specifically describes the requirements associated with 10 CFR 50.55a and function(s) specifically related to this regulation that needs to be considered in the scoping process for license renewal.

Staff from branches responsible for systems may be requested to assist in reviewing the plant design basis and intended function(s), as necessary.

The reviewer should verify that the applicant's scoping and screening methods document the actual information sources used (e.g., those identified in Table 2.1-1).

Tables 2.1-2 and 2.1-3 contain specific staff guidance on certain subjects of scoping and screening, respectively.

2.1.3.1.1 Safety-Related

The reviewer needs to ascertain how, and to what extent, the information in the CLB for the facility was incorporated by the applicant in its methodology. Specifically, the reviewer needs to review the application as well as all other relevant sources of information outlined above to identify the set of plant-specific conditions of normal operation (including anticipated operational occurrences), design basis accidents (typically described in Chapter 15 of the UFSAR), external events (e.g., those analyzed in the IPEEE for the facility), and natural phenomena (e.g., earthquakes, tornados, floods, etc.) for which the plant must be designed to ensure the following functions:

(i) The integrity of the reactor coolant pressure boundary;

(ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

(iii) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in §50.34(a)(1) or §100.11 of this chapter, as applicable.

2.1.3.1.2 Non-Safety-Related

The applicant's methodology is reviewed to ensure that non-safety related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in §54.4(a)(1) are identified as within the scope of license renewal.

The scoping criterion under 10 CFR 54.4(a)(2), in general, is intended to identify those nonsafety-related SSCs that support safety related functions. More specifically, this scoping criterion requires an applicant to identify all nonsafety-related SSCs whose failure could prevent satisfactory accomplishments of the applicable functions of the SSCs identified under 10 CFR 54.4(a)(1). The SOC (60FR22467), Section III.c (iii) contains a clarification of the Commission's intent for this requirement in the following statement:

> "The inclusion of nonsafety-related systems, structures, and components whose failure could prevent other systems, structures, and components from accomplishing a safety function is intended to provide protection against safety function failure in cases where the safety- related structure or component is not itself impaired by age-related degradation but is vulnerable to failure from the failure of another structure or component that may be so impaired."

In addition, the SOC, Section III.c (iii) provides the following guidance to assist an applicant in determining the extent to which failures need to be consider when applying this scoping criterion:

> "Consideration of hypothetical failures that could result from system interdependen-cies, that are not part of the current licensing bases and that have not been previously experienced is not required. . . . However, for some license renewal applicants, the Commission cannot exclude the possibility that hypothetical failures that are part of the CLB may require consideration of second-, third-, or fourth-level support systems."

Therefore, to satisfy the scoping criterion under 10 CFR 54.4(a)(2), an applicant needs to identify those nonsafety-related SSCs (including certain second-, third-, or fourth-level support systems) whose failure can prevent the satisfactory accomplishment of the safety-related function identified under 10 CFR 54.4(a)(1). In order to identify such systems, an applicant would consider those failures identified in (1) the documentation that makes up its CLB, (2) plant-specific operating experience, and (3) industry-wide operating experience that is specifically applicable to its facility. The applicant need not consider hypothetical failures that are not part of the CLB, and that have not been previously experienced.

In determining the nonsafety-related SSCs that are within the scope of the rule, an applicant, for example, needs to consider including such SSCs as the following: (1) the portion of a fire-protection system that supplies water to the refueling floor (even if not required by the FP Plan) that is relied upon in a design basis accident analysis as an alternate source of cooling water that can be used to mitigate the consequences from the loss of spent fuel pool cooling; (2) a nonsafety-related, non-seismically qualified building whose failure could result in the failure of a tank that is relied upon as an alternate source of cooling water needed to mitigate the consequences of a design basis event; and (3) a segment of nonsafety-related piping identified as a Seismic II/I component in the applicant's CLB. [Seismic II/I components are those non-seismic Category I systems, structures, and components interacting with seismic Category I systems, structures, and components as described in Regulatory Position C.2 of RG 1.29 (Ref. 2).] For example, the safety classification of a pipe may change throughout its course in the plant , such as at valve locations. In these instances, the applicant should identify the safety related portion of the pipe as within the scope of license renewal under 10 CFR 54.4(a)(1). However, the entire pipe run, up to and including associated piping anchors, may have been analyzed as part of the CLB to establish that it could withstand design basis event loads. If this is the case, a failure in the remainder of the pipe run or in the associated piping anchors, could render the safety-related portion of the piping unable to perform its intended function under CLB design conditions. Therefore, the reviewer must verify that the applicant's methodology would include (1) the remaining non-safety related piping up to its anchors, and (2) the associated piping anchors, as within the scope of license renewal under 10CFR 54.4(a)(2).

On the basis of the staff's experience to date, it is important to clarify that the scoping criterion under 10 CFR 54.4(a)(2) specifically applies to those functions "identified in paragraphs (a)(1)(i), (ii), and (iii)" of 10 CFR 54.4. An applicant need not extend this requirement to the scoping criteria under 10 CFR 54.4(a)(3), as is discussed below.

2.1.3.1.3 "Regulated Events"

The applicant's methodology is reviewed to ensure that systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates

compliance with the requirements of the fire protection (FP), environmental qualification (EQ), pressurized thermal shock (PTS), anticipated transients without scram (ATWS), and station blackout (SBO) regulations are identified. The reviewer should review the applicant's docketed correspondence associated with compliance of the facility with these regulations.

The scoping criteria under 10 CFR 54.4(a)(3) states that an applicant must consider *"[a]ll systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the [specified] Commission regulations[.]"* In addition, the SOC, Section III.c(iii) states that the Commission intended to limit the potential for unnecessary expansion of the review for SSCs that meet the scoping criteria under 10 CFR 54.4(a)(3), and provides additional guidance that qualifies what is meant by *"those SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission regulations. . ."* in the following statement:

> "[T]he Commission intends that this [referring to 10 CFR 54.4(a)(3)] scoping category include all systems, structures, and components whose function is relied upon to demonstrate compliance with these Commission's regulations. An applicant for license renewal should rely on the plant's current licensing bases, actual plant-specific experience, industry-wide operating experience, as appropriate, and existing engineering evaluations to determine those systems, structures, and components that are the initial focus of license renewal."

Therefore, all SSCs that are relied upon in the plant's CLB (as defined in 10 CFR 54.3), plant-specific experience, industry-wide experience (as appropriate) and existing engineering analysis to perform a function that demonstrates compliance with and operation within the Commission's regulations identified under 10 CFR 54.4(a)(3) are required to be included within the scope of the rule. For example, if a nonsafety-related diesel generator is required for safe shutdown under the fire protection plan, the diesel generator and all SSCs specifically required for that diesel to comply with and operate within the Commission's regulations based on the applicant's design specifications for that diesel shall be included within the scope of license renewal under 10 CFR 54.4 (a)(3). This may include, but should not be limited to the cooling water system or systems required for operability, the diesel support pedestal, and any applicable power supply cable specifically required for safe shutdown in the event of a fire.

In addition, the last sentence of the second paragraph in the SOC, Section III.c (iii) provides the following guidance for limiting the application of the scoping criteria under 10 CFR 54.4(a)(3) as it applies to the use of hypothetical failures:

> "Consideration of hypothetical failures that could result from system interdependen-cies, that are not part of the current licensing bases and that have not been previously experienced is not required."

The SOC does not provide any additional guidance relating to the use of hypothetical failures or the need to consider second-, third-, or fourth-level support systems for scoping under 10 CFR 54.4(a)(3). Therefore, in the absence of this guidance, an applicant need not consider hypothetical failures or second-, third-, or fourth-level support systems in determining the SSCs within the scope of the rule required by the applicable Commission regulations. For example, if a nonsafety-related diesel generator is only relied upon to remain functional to demonstrate compliance with the Commission regulations, an applicant may not need to consider the following SSCs: (1) an alternate/backup cooling water system, (2) the diesel generator non-seismically qualified building walls, or (3) an overhead segment of non-seismically qualified

piping (in a Seismic II/I configuration). This guidance is not intended to exclude any support system (identified by an applicant's CLB, actual plant-specific experience, industry-wide experience, as applicable, or existing engineering evaluations) that is specifically required for compliance with or operation within the applicable Commission regulation. For example, if a nonsafety-related diesel generator (required to demonstrate compliance with an applicable Commission regulation) specifically requires a second cooling system to cool the diesel generator Jacket Water Cooling System for the diesel to be operable, then both cooling systems must be included within the scope of the rule under 10 CFR 54.4(a)(3).

The applicant is required to identify the systems, structures, and components whose functions are relied on to demonstrate compliance with these regulated events (that is, whose functions were credited in the analysis or evaluation). Mere mention of a system, structure, or component in the analysis or evaluation does not constitute support of an intended function as required by the regulation.

For EQ, the reviewer verifies that the applicant has indicated that the EQ equipment is that equipment already identified by the licensee under 10 CFR 50.49(b). That is, equipment relied upon in safety analyses or plant evaluations to demonstrate compliance with the Commission's regulations for environmental qualification (§50.49).

The PTS regulation is only applicable to pressurized water reactors (PWRs). If the renewal application is for a PWR and the applicant relies on a Regulatory Guide 1.154 analysis to satisfy 10 CFR 50.61, the reviewer verifies that the applicant's methodology would include systems, structures, and components relied on in that analysis as within the scope of license renewal.

For SBO, the reviewer verifies that the applicant's methodology would include those systems, structures, and components relied upon during the "coping duration" phase of an SBO event (Ref. 6).

2.1.3.2 Screening

Once the systems, structures, and components within the scope of license renewal have been identified, the next step in the process is the determination of which structures and components are subject to an aging management review, i.e., "screening (Ref. 1). Note that the phrase "structures and components" applies to matters involving the integrated plant assessment (IPA) required by §54.21(a) because the aging management review required by the IPA should be a component and structure level review rather than a more general system level review (60FR22462- Footnote No. 1).

2.1.3.2.1 "Passive"

The reviewer reviews the applicant's methodology to ensure that "passive" structures and components are identified as those that perform their intended functions without moving parts or a change in configuration or properties in accordance with §54.21(a)(1)(i). The reviewer verifies that the applicant's proposed screening methodology includes consideration of structures and component intended function(s) as typified in Table 2.1-4 of this review plan section.

The license renewal rule focuses on "passive" structures and components because structures and components that have passive functions generally do not have performance and condition characteristics that are as readily "observable" as those that perform active functions. "Passive" structures and components, for the purpose of the license renewal rule, are those that perform

an intended function, as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties (Ref. 7). The description of "passive" may also be interpreted to include structures and components that do not display "a change in state." 10 CFR 54.21(a)(1)(i) provides specific examples of structures and components that meet and not meet the criterion in 10 CFR 54.21(a)(1)(i).

For example, a pump or valve has moving parts or an electrical relay can change its configuration. Therefore, the performance or condition of these components is readily monitored and would not be captured by this description. The description of "passive" may also be interpreted to include structures and components that do not display "a change in state", e.g., a battery can change its electrical properties when discharging thus demonstrating a "change in state." Batteries, therefore, would not be screened in under this criterion. Table 2.1-5 provides a list of typical structures and components identifying whether they meet 10 CFR 54.21(a)(1)(i).

Intended functions are delineated for license renewal in 10 CFR 54.4(b). Table 2.1-4 is a list of typical "passive" structure and component intended functions.

Table 2.1-5 is a list of typical structures and components, identifying whether they meet 10 CFR 54.21(a)(1)(i).

10 CFR 54.21(a)(1)(i) explicitly excludes instrumentation, such as pressure transmitters, pressure indicators, and water level indicators, from an aging management review. If an applicant determines that certain structures and components listed in Table 2.1-5 as meeting 10 CFR 54.21(a)(1)(i) do not meet that requirement for its plant, the reviewer reviews the applicant's basis for that determination.

2.1.3.2.2 "Long-Lived"

The applicant's methodology is reviewed to ensure that "long-lived" structures and components are identified as those that are not subject to periodic replacement based on a qualified life or on a specified time period. Passive structures and components that are not replaced based on a qualified life or on specified time period are considered for an aging management review.

Replacement programs may be based on vendor recommendations, plant experience, or any means, which establishes a specific replacement frequency under a controlled program. Structures and components with qualified lives or replacement intervals greater than or equal to 40 years are considered to be "long-lived."

A qualified life does not necessarily have to be based on calendar time. A qualified life based on run time or cycles are examples of qualified life references that are not based on calendar time (Ref. 6).

Structures and components that are replaced based on performance or condition are not generically excluded from an aging management review. However, performance or condition monitoring may be evaluated later in the IPA as programs to ensure functionality during the period of extended operation.

2.1.4 Evaluation Findings

When the review of the information in the license renewal application is complete and the reviewer has determined that it is satisfactory and in accordance with the acceptance criteria in Subsection 2.1.2 above, a statement of the following type should be included in the staff's safety evaluation report:

> The staff evaluation concludes that there is reasonable assurance that the applicant's methodology for identifying the systems, structures, and components within the scope of license renewal and the structures and components requiring an aging management review is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1).

2.1.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

2.1.6 References

1. NEI 95-10, Rev. 1, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Nuclear Energy Institute, January 2000.

2. Regulatory Guide 1.29, Rev. 2, "Seismic Design Classification," September 1978.

3. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," July 1981.

4. Generic Letter (GL) 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities - 10 CFR 50.54(f)," dated November 23, 1988.

5. Regulatory Guide 1.154, "Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors," January 1987.

6. Letter from Dennis M. Crutchfield of NRC to Charles H. Cruse of Baltimore Gas and Electric Company, dated April 4, 1996.

7. ANS-9, "Glossary of Terms in Nuclear Science and Technology," American Nuclear Society, 1986.

8. Letter to Douglas J. Walters, Nuclear Energy Institute, from Christopher I. Grimes, NRC, dated August 5, 1999.

9. Letter to Douglas J. Walters, Nuclear Energy Institute, from Christopher I. Grimes, NRC, dated March 10, 2000.

10. Letter to Douglas J. Walters, Nuclear Energy Institute, from Christopher I. Grimes, NRC, dated November 19, 1999.

11. Letter to Douglas J. Walters, Nuclear Energy Institute, from Christopher I. Grimes, NRC, dated September 19, 1997.

12. Letter to Douglas J. Walters, Nuclear Energy Institute, from Christopher I. Grimes, NRC, dated April 27, 1999.

Table 2.1-1. Sample Listing of Potential Information Sources

• Verified databases (A database that is subject to administrative controls to assure and maintain the integrity of the stored data or information)
• Master equipment lists (including NSSS vendor listings)
• Q-lists
• Updated Final Safety Analysis Reports
• Piping and instrument diagrams (P&IDs)
• Electrical one line or schematic drawings
• NRC Orders, Exemptions, or License Conditions for the facility
• Operations and training handbooks
• Design basis documents
• General arrangement or structural outline drawings
• Quality Assurance plan or program
• Probabilistic Risk Assessment summary report
• Maintenance Rule compliance documentation
• Design Basis Event evaluations (including plant-specific 10 CFR 50.59 evaluation procedures)
• Emergency operating procedures
• Docketed correspondence
• System interaction commitments
• Technical Specifications
• Environmental Qualification program documents
• Regulatory compliance reports (Including Safety Evaluation Reports)

Table 2.1-2. Specific Staff Guidance on Scoping

Subject	Guidance
Commodity groups	The applicant may also group like structures and components into commodity groups. Examples of commodity groups are pipe supports and cable trays. The basis for grouping structures and components can be determined by such characteristics as similar design, similar materials of construction, similar aging management practices, and similar environments. If the applicant uses commodity groups, the reviewer verifies that the applicant has described the basis for the groups.
Complex assemblies	There are some structures and components that, when combined, are considered a complex assembly (for example, diesel generator starting air skids or heating, ventilating, and air conditioning refrigerant units). For purposes of performing an aging management review, it is important to clearly establish the boundaries of review. An applicant should establish the boundaries for such assemblies by identifying each structure and component that makes up the complex assembly and determining whether or not each structure and component is subject to an aging management review (Ref. 1).
Hypothetical failures	For 10 CFR 54.4(a)(2), an applicant should consider those failures identified in (1) the documentation that makes up its CLB, (2) plant-specific operating experience, and (3) industry-wide operating experience that is specifically applicable to its facility. For example, an applicant should consider including: (1) the portion of a fire-protection system that supplies water to the refueling floor (even if not required by its Fire Protection Plan) that is relied upon in a design basis accident analysis as an alternate source of cooling water that can be used to mitigate the consequences from the loss of spent fuel pool cooling, (2) a non-safety-related, non-seismically qualified building whose failure could result in the failure of a tank that is relied upon as an alternate source of cooling water needed to mitigate the consequences of a DBE, and (3) a segment of non-safety-related piping identified as a Seismic II/I component in the applicant's CLB (Ref. 8).
Cascading	For 10 CFR 54.4(a)(3), an applicant need not consider hypothetical failures or second-, third, or fourth-level support systems. For example, if a non-safety related diesel generator is only relied upon to remain functional to demonstrate compliance with the Commission regulations, an applicant may not need to consider: (1) an alternate/backup cooling water system, (2) the diesel generator non-seismically qualified building walls, or (3) an overhead segment of non-seismically qualified piping (in a Seismic II/I configuration). An applicant may not exclude any support system (identified by its CLB, actual plant-specific experience, industry-wide experience, as applicable, or existing engineering evaluations) that is specifically required for compliance with or operation within applicable Commission regulation. For example, if a non safety-related diesel generator (required to demonstrate compliance with an applicable Commission regulation) specifically requires a second cooling system to cool the diesel generator Jacket Water Cooling System for the diesel to be operable, then both cooling systems must be included within the scope of the rule (Ref. 8).

Table 2.1-3. Specific Staff Guidance on Screening

Subject	Guidance
Consumables	Consumables may be divided into the following four categories for the purpose of license renewal: (a) packing, gaskets, component seals, and O-rings; (b) structural sealants; (c) oil, grease, and component filters; and (d) system filters, fire extinguishers, fire hoses, and air packs. The consumables in both categories (a) and (b) are considered as subcomponents and are not explicitly called out in the scoping and screening procedures. Rather, they are implicitly included at the component level (i.e., if a valve is identified as being in scope, a seal in that valve would also be in scope as a subcomponent of that valve). Thus, these consumables are to be considered in the aging management review as part of the associated component. The consumables in categories (c) are short-lived and periodically replaced and can be excluded from an aging management review on that basis. Likewise, the consumables that fall within category (d) are typically replaced based on condition and may be excluded on a plant-specific basis, subject to justification by the applicant (Ref. 9).
Heat exchanger intended functions	Both the pressure boundary and heat transfer functions for heat exchangers should be considered, because heat transfer may be a primary safety function of these components. There may be a unique aging effect associated with different materials in the heat exchanger parts that are associated with the heat transfer function and not the pressure boundary function. The staff would expect that the programs that effectively manage aging effects of the pressure boundary function can, in conjunction with the procedures for monitoring heat exchanger performance, effectively manage aging effects applicable to the heat transfer function (Ref. 10).
Multiple functions	Structures and components may have multiple functions, but only the intended function(s) as delineated in 10 CFR 54.4(b) are to be reviewed for license renewal. Further, some functions of "active" components may meet the criteria of the "passive" description. For example, although a pump or a valve has some moving parts, a pump casing or valve body performs a pressure retaining function without moving parts. A pump casing or a valve body meets this description and would therefore be considered for an aging management review. However, the moving parts of the pump, such as the pump impeller, would not be subject to the aging management review. The reviewer verifies that the applicant has considered multiple functions in identifying structure and component intended function(s).
Piece-parts	An applicant does not have to perform a renewal review of structures and components at a piece part level. However, there are instances where an aging management review should be considered for certain components. Bolting is an example. If bolting contributes to the performance of a component intended function without moving parts, or without a change in configuration or properties, the bolting is subject to an aging management review for renewal. Examples are: bolting on a pressurizer manway cover, valve bonnet-to-body bolting, bolting on a pump support, and diesel

	generator embedment plate anchors. However, if bolting contributes to the performance of component intended function with moving parts, or with a change in configuration or properties, the bolting is not subject to an aging management review for renewal. Degradation of such bolting would be revealed through the active performance of the component, for example, bolting to assemble a pump impeller.

Table 2.1-4. Typical "Passive" Structure and Component Intended Functions

Provide structural support to safety-related components.
Provide rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
Provide shelter/protection to safety-related components.
Provide flood protection barrier (internal and external flooding event).
Provide pressure boundary or fission product retention barrier to protect public health and safety in the event of any postulated design basis events.
Provide spray shield or curbs for directing flow (e.g., safety injection flow to containment sump).
Provide pressure-retaining boundary so that sufficient flow and adequate pressure is delivered.
Provide shielding against radiation.
Provide missile barrier (internally or externally generated).
Provide shielding against high energy line breaks.
Provide structural support to nonsafety-related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions.
Provide insulation resistance to preclude shorts, grounds and unacceptable leakage current.
Provide pipe whip restraint.

Table 2.1-5. Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
1	Structures	Category I Structures	Yes
2		Primary Containment Structure	Yes
3		Intake Structures	Yes
4		Intake Canal	Yes
5		Other Non-Category I Structures Within the Scope of License Renewal	Yes
6		Equipment Supports and Foundations	Yes
7		Structural Bellows	Yes
8		Controlled Leakage Doors	Yes
9		Penetration Seals	Yes
10		Compressible Joints and Seals	Yes
11		Fuel Pool and Sump Liners	Yes
12		Concrete Curbs	Yes
13		Offgas Stack and Flue	Yes
14		Fire Barriers	Yes
15		Pipe Whip Restraints and Jet Impingement Shields	Yes
16		Electrical and Instrumentation and Control Penetration Assemblies	Yes
17		Instrument Racks, Frames, Panels, and Enclosures	Yes
18		Electrical Panels, Racks, Cabinets, and Other Enclosures	Yes
19		Cable Trays and Supports	Yes
20		Conduit	Yes
21		Tube Track	Yes
22		Reactor Vessel Internals	Yes

Table 2.1-5. Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment (cont'd)

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
23	Structures(Contd.)	ASME Class 1 Hangers and Supports	Yes
24		Non-ASME Class 1 Hangers and Supports	Yes
25		Snubbers	No
26	Reactor Coolant Pressure Boundary Components (Note: the components of the RCPB are defined by each plant's CLB and site specific documentation)	ASME Class 1 Piping	Yes
27		Reactor Vessel	Yes
28		Reactor Coolant Pumps	Yes (Casing)
29		Control Rod Drives	No
30		Control Rod Drive Housing	Yes
31		Steam Generators	Yes
32		Pressurizers	Yes
33	Non-Class 1 Piping Components	Underground Piping	Yes
34		Piping in Low Temperature Demineralized Water Service	Yes
35		Piping in High Temperature Single Phase Service	Yes
36		Piping in Multiple Phase Service	Yes
37		Service Water Piping	Yes
38		Low Temperature Gas Transport Piping	Yes
39		Stainless Steel Tubing	Yes
40		Instrument Tubing	Yes
41		Expansion Joints	Yes
42		Ductwork	Yes
43		Sprinklers Heads	Yes

Table 2.1-5. Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment (cont'd)

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
44	Non-Class 1 Piping Components (Contd.)	Miscellaneous Appurtenances (includes fittings, couplings, reducers, elbows, thermowells, flanges, fasteners, welded attachments, etc.)	Yes
44		Miscellaneous Appurtenances (includes fittings, couplings, reducers, elbows, thermowells, flanges, fasteners, welded attachments, etc.)	Yes
45	Pumps	ECCS Pumps	Yes (Casing)
46		Service Water and Fire Pumps	Yes (Casing)
47		Lube Oil and Closed Cooling Water Pumps	Yes (Casing)
48		Condensate Pumps	Yes (Casing)
49		Borated Water Pumps	Yes (Casing)
50		Emergency Service Water Pumps	Yes (Casing)
51		Submersible Pumps	Yes (Casing)
52	Turbines	Turbine Pump Drives (excluding pumps)	Yes (Casing)
53		Gas Turbines	Yes (Casing)
54		Controls (actuator and overspeed trip)	No
55	Engines	Fire Pump Diesel Engines	No
56	Emergency Diesel Generators	Emergency Diesel Generators	No
57	Heat Exchangers	Condensers	Yes
58		HVAC Coolers	Yes
59		Primary Water System Heat Exchangers	Yes
60		Treated Water System Heat Exchangers	Yes
61		Closed Cooling Water System Heat Exchangers	Yes

Table 2.1-5. Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment (cont'd)

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
62	Heat Exchangers (Contd.)	Lubricating Oil System Heat Exchangers	Yes
63		Raw Water System Heat Exchangers	Yes
64		Containment Atmospheric System Heat Exchangers	Yes
65	Motors	ECCS and Emergency Service Water Pump Motors	No
66		Small Motors	No
67	Miscellaneous Process Components	Gland Seal Blower	No
68		Recombiners	*
70		Strainers	Yes
71		Rupture Disks	Yes
72		Steam Traps	Yes
73		Restricting Orifices	Yes
74		Air Compressor	No
75	Instrumentation	Solenoid Operator	No
76		Differential Pressure Indicators	No
77		Differential Pressure Indicating Switches	No
78		Differential Pressure Switches	No
79		Differential Pressure Transmitters	No
80		Pressure Indicators	No
81		Pressure Indicator Switches	No
82		Pressure Switches	No
83		Pressure Transmitters	No
84		Flow Switches	No
85		Flow Transmitters	No
86		Conductivity Elements	Yes (PB only)
87		Conductivity Switches	No
88		Flow Element	Yes (PB only)

Table 2.1-5. Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment (cont'd)

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
89	Instrumentation (Contd.)	Level Indicating Switches	No
90		Level Transmitters	No
91		Temperature Indicating Switches	No
92		Temperature Switches	No
93		Temperature Sensors	Yes (PB only)
94		Radiation Sensors	Yes (PB only)
95		Radiation Monitors	No
96		Radiation Transmitter	No
97		Gas Analyzer/Transmitter	No
98		Moisture Switch	No
99		Position Switch	No
100		Vibration Switch	No
101		Differential Pressure Indicating Controller	No
102		Flow Indicator	No
103		Flow Indicating Controller	No
104		Alarm Unit	No
105		Level Indicator	No
106		Level Switch	No
107		Temperature Controller	No
108		Power Supply	No
109		Converter-Voltage/Current	No
110		Converter-Voltage/Pneumatic	No
111		Controller	No
112		Isolator	No
113		Signal Conditioner	No
114		Recorder	No
115		Annunciators	No
116		Ammeters	No
117		Speed Indicators	No
118		Temperature Indicators	No
119		Speed Controllers	No

Table 2.1-5. Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment (cont'd)

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
120	Instrumentation (Contd.)	Watt Transducers	No
121		Thermocouple, RTD	Yes
122		Instrument Transformer	No (Ref. 11)
123	Electrical Components	4.16 kV Switchgear Unit	No
124		480V Load Centers	No
125		480V Motor Control Centers	No
126		250 VDC Motor Control Centers	No
127		Transistors	No
128		Circuit Breakers	No
129		Protective Relays	No
131		Control Switches	No
132		Automatic Transfer Switches	No
133		Manual Transfer and Disconnect Switches	No
134		Batteries	No
135		Battery Chargers/Inverters	No
136		Motor-Generator Sets	No
137		Distribution Panel Internal Component Assemblies (includes internal devices including switches, breakers, indicating lights, etc.)	No
138		Electrical Controls and Panel Internal Component Assemblies (includes internal devices including switches, breakers, indicating lights, etc.)	No
139		Heat Tracing	No (Ref. 11)
140		Electric Heaters	No (Ref. 11)
141		Connectors, Electrical Splices, Terminal Blocks	Yes
142		Power, Control, and Instrumentation Cables	Yes

Table 2.1-5. Typical Strictures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment (cont'd)

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
134	Electrical Components(Contd.)	Batteries	No
135		Battery Chargers/Inverters	No
136		Motor-Generator Sets	No
137		Distribution Panel Internal Component Assemblies (includes internal devices including switches, breakers, indicating lights, etc.)	No
138		Electrical Controls and Panel Internal Component Assemblies (includes internal devices including switches, breakers, indicating lights, etc.)	No
139		Heat Tracing	No (Ref. 11)
140		Electric Heaters	No (Ref. 11)
141		Connectors, Electrical Splices, Terminal Blocks	Yes
142		Power, Control, and Instrumentation Cables	Yes
143		Load Center Transformers	No (Ref. 11)
144		Small Distribution Transformers	No (Ref. 11)
145		Fuses	No (Ref. 12)
146	Valves	Hydraulic Operated Valves	Yes (Bodies)
147		Explosive Valves	Yes (Bodies)
148		Manual Valves	Yes (Bodies)
149		Small Valves	Yes (Bodies)
150		Motor-Operated Valves	Yes (Bodies)
151		Air-Operated Valves	Yes (Bodies)
152		Main Steam Isolation Valves	Yes (Bodies)
153		Small Relief Valves	Yes (Bodies)
154		Check Valves	Yes (Bodies)
155		Safety Relief Valves	Yes (Bodies)
156		Dampers	No
157	Tanks	Air Accumulators	Yes

Table 2.1-5. Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment (cont'd)

Item	Category	Structure, Component, or Commodity Group	Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)
158	Tanks (Contd.)	Discharge Accumulators (Dampers)	Yes
159		Boron Acid Storage Tanks	Yes
160		Above Ground Oil Tanks	Yes
161		Underground Oil Tanks	Yes
162		Demineralized Water Tanks	Yes
163		Neutron Shield Tank	Yes
164	Fans	Ventilation Fans	No
165		Other Fans	No
166	Miscellaneous	Emergency Lighting	No
167		Hose Stations	Yes
168	Subcomponent	Packing, Gaskets, Components Seals, and O-rings	Yes[1] (Ref. 9)
169		Structural Sealants	Yes[2] (Ref. 9)
170	Consumable	Oil, Grease, and Component Filters	No[3] (Ref. 9)
171		System Filters, Fire Extinguishers, Fire Hoses, and Air Packs	Yes[4] (Ref. 9)

*The applicant should identify the intended function(s) and apply the IPA process to determine whether the structure, component, or commodity grouping meets 10 CFR 54.21(a)(1)(i).

1 These subcomponents would not necessarily be called out explicitly in the scoping and screening procedures. Instead they would be implicitly addressed at the component level. The applicant will be able to exclude these subcomponents utilizing a clear basis such as the example of ASME Section III not being relied upon for pressure boundary.

2 These subcomponents would not necessarily be called out explicitly in the scoping and screening procedures. Instead they would be implicitly addressed at the component level. Structural sealants may perform functions without moving parts or change in configuration and they are not typically replaced. It is expected that the applicant's structural aging management program will address these items with respect to an aging management review program on a plant specific basis.

3 For these commodities, the screening process would be expected to exclude these materials because they are short-lived and are periodically replaced.

4 These components may be excluded, on a plant-specific basis, from an aging management review under 10 CFR 54.21(a)(1)(ii) in that they are replaced on condition. The application should identify the standards that are relied on for replacement as part of the methodology description, for example, NFPA standards for fire protection equipment.

2.2 PLANT LEVEL SCOPING RESULTS

Review Responsibilities

Primary - Branches responsible for systems
Secondary - Branch responsible for electrical engineering

2.2.1 Areas of Review

This review plan section addresses the plant level scoping results for license renewal. An applicant is required by 10 CFR 54.21(a)(1) to identify and list structures and components subject to an aging management review. These are "passive," "long-lived" structures and components that are within the scope of license renewal. In addition, an applicant is required by 10 CFR 54.21(a)(2) to describe and justify methods used to identify these structures and components. The staff reviews the applicant's methodology separately following the guidance in Section 2.1 of this standard review plan.

An applicant would list all plant level systems and structures. Based on the Design Basis Events (DBEs) in the plant's current licensing basis (CLB) and other CLB information relating to non-safety-related systems and structures and certain regulated events, the applicant would identify those plant level systems and structures within the scope of license renewal, as defined in 10 CFR 54.4(a). This is "scoping" of the plant level systems and structures for license renewal. To verify that the applicant has properly implemented its methodology, the staff focuses its review on the implementation results to confirm that there is no omission of plant level systems and structures within the scope of license renewal.

Examples of plant systems are the reactor coolant system, containment spray, standby gas treatment (BWR), emergency core cooling, open and closed cycle cooling water, compressed air, chemical and volume control (PWR), standby liquid control (BWR), main steam, feedwater, condensate, steam generator blowdown (PWR), and auxiliary feedwater systems.

Examples of plant structures are the primary containment, secondary containment (BWR), control room envelope, auxiliary building, fuel storage building, radwaste building, and ultimate heat sink cooling tower.

Examples of components are the reactor vessel, reactor vessel internals, steam generator (PWR), and light and heavy load handling cranes. Some applicants may have categorized such components as plant "systems" for their convenience.

After the plant level scoping, an applicant would identify the portion of the system or structure that performs intended function(s), as defined in 10 CFR 54.4(b). Then, the applicant would identify those structures and components that are "passive" and "long-lived" in accordance with 10 CFR 54.21(a)(1)(i) and (ii). These "passive," "long-lived" structures and components are those that are subject to an aging management review. The staff reviews these results separately following the guidance in Sections 2.3 through 2.5 of this standard review plan.

An applicant has the flexibility to determine the set of systems and structures for which it considers as within the scope of license renewal, provided that this set encompasses the systems and structures for which the Commission has determined as within the scope of license renewal. Therefore, the reviewer should not review systems and structures that the applicant

has identified as within the scope of license renewal, because it is an applicant's option to include more systems and components than those required by 10 CFR 54.4.

The following area relating to the methodology implementation results for the plant level systems and structures are reviewed:

2.2.1.1 Systems and Structures Within the Scope of License Renewal

The reviewer verifies the applicant's identification of plant level systems and structures that are within the scope of license renewal.

2.2.2 Acceptance Criteria

The acceptance criteria for the area of review define methods for meeting the requirements of the Commission regulations in 10 CFR 54.4. For the applicant's implementation of its methodology in 10 CFR 54.21(a)(2) to be acceptable, the staff should find no omission of plant level systems and structures within the scope of license renewal.

2.2.2.1 Systems and Structures Within the Scope of License Renewal

Systems and structures are within the scope of license renewal as delineated in 10 CFR 54.4(a) if they are:

1. Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events [as defined in 10 CFR 50.49(b)(1)] to ensure the following functions:

(i) The integrity of the reactor coolant pressure boundary,

(ii) The capability to shut down the reactor and maintain it in a safe shutdown condition, or

(iii) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in 10 CFR 50.34(a)(1) or 10 CFR 100.11, as applicable.

2. Non-safety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10CFR 54.4(a)(1) above.

3. Systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

2.2.3 Review Procedures

For the area of review, the following review procedures are to be followed:

2.2.3.1 Systems and Structures Within the Scope of License Renewal

The reviewer determines whether the applicant has properly identified the plant level systems and structures within the scope of license renewal. To make that determination, the reviewer should review selected systems and structures that the applicant did not identify as within the scope of license renewal to verify that they do not have any intended functions. The branch responsible for electrical engineering may be requested to assist the review regarding electrical system scoping.

The reviewer should use the plant Updated Final Safety Analysis Report (UFSAR), orders, applicable regulations, exemptions, and license conditions to determine the design basis for the systems, structures, and components (if components are identified as "systems" by the applicant). The design basis determines the intended function(s) of a system, structure, or component, which in turn, determines whether the system, structure, or component is within the scope of license renewal.

This review plan section addresses scoping at a plant level. Thus, if any portion of a system or structure performs an intended function as defined in 10 CFR 54.4(b), the system or structure is within the scope of license renewal. The review of the individual portions of systems and structures that are within the scope of license renewal are addressed separately in Sections 2.3 through 2.5 of this standard review plan.

An applicant should submit a list of all plant level systems and structures, identifying those that are within the scope of license renewal. The reviewer should select systems and structures that the applicant did not identify as within the scope of license renewal. The following are a few examples:

1. An applicant does not identify its radiation monitoring system as within the scope of license renewal. The reviewer may review the UFSAR to verify that this particular system does not perform any intended functions at the applicant's plant.

2. An applicant does not identify its polar crane as within the scope of license renewal. The reviewer may review the plant's UFSAR to verify that this particular structure for the applicant's plant is not "seismic II over I," denoting a non-seismic Category I structure interacting with seismic Category I structure as described in Position C.2 of Regulatory Guide 1.29, "Seismic Design Classification" (Ref. 1).

3. An applicant does not identify its fire protection pump house as within the scope of license renewal. The reviewer may review the plant's commitments to the fire protection regulation (10 CFR 50.48) to verify that this particular structure does not perform any intended functions at the applicant's plant.

4. An applicant uses the "spaces" approach for scoping electrical equipment and elects to include all electrical equipment on site to be within the scope of license renewal, with the exception of the 525kV switchyard and the 230kV transmission lines. The reviewer may review the plant's UFSAR and commitments to the station blackout regulation (10 CFR 50.63) to verify that the 525kV switchyard and the 230kV transmission lines do not perform any intended functions at the applicant's plant.

Table 2.2-1 of this review plan section contains additional examples based on lessons learned from the review of the initial license renewal applications, including a discussion of the plant-

specific basis for disposition, of determining whether a system or structure is within the scope of license renewal.

An applicant may choose to group similar components and structures together in commodity groups for separate analyses. It is acceptable for an applicant to identify a particular system or structure as not within the scope of license renewal, if the only portion of the system or structure that has any intended functions is addressed separately in specific commodity groups.

The reviewer should find no omissions by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the plant level systems and structures within the scope of license renewal.

Section 2.1 of this standard review plan contains additional guidance on the following:

- commodity groups
- complex assemblies
- hypothetical failure
- cascading

2.2.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provision of this standard review plan and that the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that there is reasonable assurance that the applicant has appropriately identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4.

2.2.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specific portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

2.2.6 References

1. Regulatory Guide 1.29, Rev. 2, "Seismic Design Classifications," September 1978.

Table 2.2-1. Examples of System and Structure Scoping and Basis for Disposition

Example	Disposition
Recirculation cooling water system	One function of the recirculation cooling water system is to remove decay heat from the stored fuel in the spent fuel pool. However, the fuel handling accident for the plant assumes that the spent fuel pool cooling, thus the recirculation cooling water system, is not functional during or following such an event. Thus, the recirculation cooling water system is not within the scope of license renewal because of this function.
Station blackout diesel generator building	The UFSAR indicates that certain structural components of the station blackout diesel generator building for the plant are designed to preclude seismic failure and subsequent impact of the structure on the adjacent safety-related emergency diesel generator building. In addition, the UFSAR indicates that certain equipments on the building have been anchored to resist tornado wind loads. Thus, the station blackout diesel generator building is within the scope of license renewal.

2.3 SYSTEM SCOPING AND SCREENING RESULTS: MECHANICAL

Review Responsibilities

Primary - Branches responsible for systems
Secondary - None

2.3.1 Areas of Review

This review plan section addresses the mechanical systems scoping and screening results for license renewal. Typical mechanical systems consist of the following:

Reactor Coolant System (such as reactor vessel and internals, coolant pressure boundary, coolant system and connected lines, and steam generators).

Engineered Safety Features (such as containment spray and isolation systems, standby gas treatment system, emergency core cooling system, and fan cooler system).

Auxiliary Systems (such as new and spent fuel storage, spent fuel cooling and cleanup, suppression pool cleanup, load handling, open and closed cycle cooling water, ultimate heat sink, compressed air system, chemical and volume control system, standby liquid control system, reactor water cleanup, coolant storage/refueling water, shutdown water, ventilation, diesel generator, fire protection, and liquid waste disposal).

Steam and Power Conversion System (such as turbines, main and extraction steam, feedwater, condensate, steam generator blowdown, and auxiliary feedwater).

An applicant is required by 10 CFR 54.21(a)(1) to identify and list structures and components subject to an aging management review. These are "passive," "long-lived" structures and components that are within the scope of license renewal. In addition, an applicant is required by 10 CFR 54.21(a)(2) to describe and justify methods used to identify these structures and components. The staff reviews the applicant's methodology separately following the guidance in Section 2.1 of this standard review plan. To verify that the applicant had properly implemented its methodology, the staff focuses its review on the implementation results to confirm that there is no omission of mechanical system components that are subject to an aging management review.

An applicant would list all plant level systems and structures. Based on the Design Basis Events (DBEs) in the plant's current licensing basis (CLB) and other CLB information relating to non-safety-related systems and structures and certain regulated events, the applicant would identify those plant level systems and structures within the scope of license renewal, as defined in 10 CFR 54.4(a). This is "scoping" of the plant level systems and structures for license renewal. The staff reviews the applicant's plant level "scoping" results separately following the guidance in Section 2.2 of this standard review plan.

For a mechanical system that is within the scope of license renewal, an applicant would identify the portion of the system that performs intended function(s), as defined in 10 CFR 54.4(b). The applicant identifies this particular portion of the system in marked-up piping and instrument

diagrams (P&IDs). This is "scoping" of mechanical components in a system to identify those that are within the scope of license renewal for a system.

For the mechanical components within this particular portion of the system, an applicant would identify those that are "passive" and "long-lived" in accordance with 10 CFR 54.21(a)(1)(i) and (ii). These "passive," "long-lived" mechanical components are those that are subject to an aging management review. This is "screening" of mechanical components in a system to identify those that are "passive" and "long-lived."

The applicant has the flexibility to determine the set of structures and components for which an aging management review is performed, provided that this set encompasses the structures and components for which the Commission has determined an aging management review is required. This is based on the statements of consideration for the license renewal rule (60 FR 22478). Therefore, the reviewer should not review components that the applicant has identified as subject to an aging management review, because it is an applicant's option to include more components than those required by 10 CFR 52.21(a)(1).

The following areas relating to the methodology implementation results for the mechanical systems are reviewed:

2.3.1.1 Components Within the Scope of License Renewal

The applicant's identification of mechanical system components that are within the scope of license renewal is reviewed. (Scoping)

2.3.1.2 Components Subject to an Aging Management Review

The applicant's identification of mechanical system components within the scope of license renewal that are "passive" and "long-lived" is reviewed. (Screening)

2.3.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(a)(1). For the applicant's implementation of its methodology in 10 CFR 54.21(a)(2) to be acceptable, the staff should find no omission of mechanical system components that are subject to an aging management review.

2.3.2.1 Components Within the Scope of License Renewal

Mechanical components are within the scope of license renewal as delineated in 10 CFR 54.4(a) if they are:

1. Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49(b)(1)) to ensure the following functions --

   (i) The integrity of the reactor coolant pressure boundary;

   (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

(iii) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in 10 CFR 50.34(a)(1) or 10 CFR 100.11, as applicable.

2. All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii).

3. All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

2.3.2.2 Components Subject to Aging Management Review

Mechanical components are subject to an aging management review if they are within the scope of license renewal and perform an intended function as defined in 10 CFR 54.4(b) without a change in configuration or properties ("passive"), and are not subject to replacement based on a qualified life or specified time period ("long-lived") (10 CFR 54.21(a)(1)(i) and (ii)).

2.3.3 Review Procedures

For each area of review, the following review procedures are to be followed:

2.3.3.1 Components Within the Scope of License Renewal

This step determines whether the applicant has properly identified the components within the scope of license renewal. The reviewer should review selected components that the applicant did not identify as within the scope of license renewal to verify that they did not omit components with intended functions.

The reviewer should use the plant Updated Final Safety Analysis Report (UFSAR), orders, applicable regulations, exemptions, and license conditions to determine the design basis for the systems, structures, and components. The design basis determines the system intended function(s), which in turn, determines the components within that system that are required for the system to perform its intended functions.

An applicant should provide plant drawing (P&IDs) marking the portion of the system that is within the scope of license renewal. The reviewer should focus the review on those components that are not identified as being within the scope of license renewal, especially boundary points and major system components, to ensure the applicant has not omitted components that are required for the system to perform its intended functions. Portions of the system identified as being within the scope of license renewal by the applicant do not have to be identified by the reviewer because the applicant has the option of including more components than the rule requires to be in the scope.

For example, if a portion of a system does not perform an intended function, is not identified as being within the scope of license renewal, and is isolated from the portion of the system that is

identified as being within the scope of license renewal by a boundary valve, the reviewer should verify that this particular boundary valve is identified as being within the scope of license renewal, or that the valve does not have an intended function (that is, the valve is not required for the system to perform its intended function). Another example, the reviewer should sample the system function of piping runs and components that are not identified as being within the scope of license renewal to ensure they do no meet the requirement of 10 CFR 54.4.

Further, the reviewer should select functions described in the UFSAR to verify that components having intended functions were not omitted from the scope of the rule. The reviewer should find no omissions of components within the scope of license renewal by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the components within the scope of license renewal for the mechanical systems.

Section 2.1 of this standard review plan contains additional guidance on the following:

- commodity groups
- complex assemblies
- scoping events
- hypothetical failure
- cascading

Table 2.3-1 provides examples of mechanical components scoping lessons learned from the review of the initial license renewal applications and basis for disposition.

At the completion of this review step, the reviewer has confidence that the applicant has identified the components within the scope of license renewal.

2.3.3.2 Components Subject to an Aging Management Review

This step determines whether the applicant has properly identified the components subject to an aging management review from among those identified in the previous step, that is, Subsection 2.3.3.1 of this review plan section. The reviewer should review selected components that the applicant has identified as within the scope of license renewal to verify that the applicant has identified these components as subject to an aging management review if they perform intended functions without moving parts or without a change in configuration or properties and are not subject to replacement on the basis of a qualified life or specified time period.

Starting with the boundary verified in Subsection 2.3.3.1 of this review plan, the reviewer should sample components that are within the scope of license renewal for that system, but were not identified by the applicant as subject to an aging management review. Only components that are "passive" and "long-lived" are subject to an aging management review. Table 2.1-2 of Section 2.1 of this standard review plan is provided for the reviewer to assist in identifying whether certain components are "passive." Applicant should justify omitting a component that is within the scope of license renewal at their facility and is listed as "passive" on Table 2.1-2.

For example, an applicant has marked a boundary of a certain system that is within the scope of license renewal. The marked-up P&ID shows that there are piping, valves, and air compressors within this boundary. The applicant has identified piping and valve bodies as subject to an

aging management review. The reviewer verifies that Table 2.1-2 of Section 2.1 of this standard review plan indicates air compressors are not subject to an aging management review.

The reviewer should find no omissions of components subject to an aging management review by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the components subject to an aging management review for the mechanical systems.

Section 2.1 of this standard review plan contains additional guidance on screening the following:

- consumables
- heat exchanger intended functions
- multiple functions
- piece-parts

Table 2.3-2 provides examples of mechanical components screening lessons learned from the review of the initial license renewal applications and basis for disposition.

The applicant should also identify the component intended functions required to be managed by 10 CFR 54.4. Table 2.3-3 provides examples of mechanical component intended functions.

At the completion of the review step, the reviewer has confidence that the applicant has identified the "passive," "long-lived" components subject to an aging management review.

2.3.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provision of this review plan section and that the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that there is a reasonable assurance that the applicant has appropriately identified the mechanical system components subject to an aging management review to meet the requirements stated in 10 CFR 54.21(a)(1).

2.3.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specific portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

2.3.6 References

None

Table 2.3-1. Examples of Mechanical Components Scoping and Basis for Disposition

Example	Disposition
Piping segment that provides structural support	The safety-related/non-safety-related boundary along a pipe run may occur at a valve location. The piping segment between this valve and the next seismic anchor provides structural support in a seismic event. This piping segment is within the scope of license renewal.
Containment heating and ventilation system ductwork downstream of the fusible links providing cooling to the steam generator compartment and reactor vessel annulus	This non-safety-related ductwork provides cooling to support the applicant's environmental qualification (EQ) program. However, the failure of the cavity cooling system ductwork will not prevent the satisfactory completion of any critical safety function during and following a design basis accident. Thus, this ductwork is not within the scope of license renewal.
Standpipe installed inside the fuel oil storage tank	The standpipe ensures that there is sufficient fuel oil reserve for the emergency diesel generator to operate for the specified number of days in the plant technical specifications following design basis events. Therefore, this standpipe is within the scope of license renewal.
Insulation on boron injection tank	The temperature is high enough that insulation is not necessary to prevent boron precipitation. Technical specifications require periodic verification of the tank temperature. Thus the insulation is not relied on to ensure the function of the emergency system and is not within the scope of license renewal.
Pressurizer spray head	The spray head is not credited for the mitigation of any accidents addressed in the UFSAR accident analyses. The function of the pressurizer spray is to reduce reactor coolant system pressure during normal operating conditions. Therefore, the spray head is not within the scope of license renewal.

Table 2.3-2. Examples of Mechanical Components Screening and Basis for Disposition

Example	Disposition
Diesel engine jacket water heat exchanger, and portions of the diesel fuel oil system and starting air system supplied by a vendor on a diesel generator skid	These are "passive," "long-lived" components having intended functions. They are subject to an aging management review for license renewal even though the diesel generator is considered "active."
Fuel assemblies	The fuel assemblies are replaced at regular intervals based on the fuel cycle of the plant. They are not subject to an aging management review.
Valve internals (such as disk and seat)	10 CFR 54.21(a)(1)(i) excludes valves, other than the valve body, from aging management review. The statements of consideration of the license renewal rule provide the basis for excluding structures and components that perform their intended functions with moving parts or with a change in configuration or properties. Although the valve body is subject to an aging management review, valve internals are not.

Table 2.3-3. Examples of Mechanical Component Intended Functions

Component	Intended Function*
Piping	Pressure boundary
Valve body	Pressure boundary
Pump casing	Pressure boundary
Orifice	Pressure boundary Flow restriction
Heat exchanger	Pressure boundary Heat transfer
Reactor vessel internals	Structural support of fuel assemblies, control rods, and incore instrumentation, to maintain core configuration and flow distribution

*The component intended function(s) are those that support the system intended function(s). For example, a heat exchanger in the spent fuel cooling system has a pressure boundary intended function, but may not have a heat transfer function. Similarly, not all orifices have flow restriction as an intended function.

2.4 STRUCTURE SCOPING AND SCREENING RESULTS

Review Responsibilities

Primary - Branch responsible for plant systems
Secondary - None

2.4.1 Areas of Review

This review plan section addresses the scoping and screening results of structures and structural components for license renewal. Typical structures include the following:

- The primary containment structure
- Building structures, such as the intake structure, diesel generator building, auxiliary building, and turbine building.
- Component supports, such as cable trays, pipe hangers, elastomer vibration isolators, equipment frames and stanchions, and HVAC ducting supports.
- Non-safety-related structures whose failure could prevent safety-related systems, structures, and components from performing their intended functions (that is, seismic Category II over I structures).

Typical structural components include the following: liner plates, walls, floors, roofs, foundations, doors, beams, columns, and frames.

An applicant is required by 10 CFR 54.21(a)(1) to identify and list structures and components subject to an aging management review. These are "passive," "long-lived" structures and components that are within the scope of license renewal. In addition, an applicant is required by 10 CFR 54.21(a)(2) to describe and justify methods used to identify these structures and components. The staff reviews the applicant's methodology separately following the guidance in Section 2.1 of this standard review plan. To verify that the applicant had properly implemented its methodology, the staff focuses its review on the implementation results to confirm that there is no omission of structural components that are subject to an aging management review by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the structural components subject to an aging management review.

An applicant should list all plant level systems and structures. Based on the Design Basis Events (DBEs) in the plant's current licensing basis (CLB) and other CLB information relating to non-safety-related systems and structures and certain regulated events, the applicant would identify those plant level systems and structures within the scope of license renewal, as defined in 10 CFR 54.4(a). This is "scoping" of the plant level systems and structures for license renewal. The staff reviews the applicant's plant level "scoping" results separately following the guidance in Section 2.2 of this standard review plan.

For structures that are within the scope of license renewal, an applicant should identify the structural components that are "passive" and "long-lived" in accordance with 10 CFR 54.21(a)(1)(i) and (ii). These "passive," "long-lived" structural components are those that are subject to an aging management review ("screening"). The applicant's methodology

implementation results for identifying structural components subject to an aging management review is the area of review.

The applicant has the flexibility to determine the set of structures and components for which an aging management review is performed, provided that this set encompasses the structures and components for which the Commission has determined that an aging management review is required. This flexibility is described in the statements of consideration for the license renewal rule (60 FR 22478). Therefore, the reviewer should not focus the review on structural components that the applicant has already identified as subject to an aging management review, because it is an applicant's option to include more structural components than those required by 10 CFR 52.21(a)(1). Rather the reviewer should focus on those structural components that are not included by the applicant as subject to an aging management review to ensure that they do not perform an intended function as defined in 10 CFR 54.4(b) or are not "passive" and "long-lived."

2.4.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(a)(1). For the applicant's implementation of its methodology in 10 CFR 54.21(a)(2) to be acceptable, the staff should confirm there is no omission of structural components that are subject to an aging management review by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the structural components subject to an aging management review.

2.4.2.1 Structural Components Subject to Aging Management Review

Structural components are within the scope of license renewal as delineated in 10 CFR 54.4(a) if they are:

1. Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events [as defined in 10 CFR 50.49(b)(1)] to ensure the following functions --

   (i) The integrity of the reactor coolant pressure boundary;

   (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

   (iii) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in 10 CFR 50.34(a)(1) or 10 CFR 100.11, as applicable.

2. All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii).

3. All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

Structural components are subject to an aging management review if they are within the scope of license renewal and perform an intended function as defined in 10 CFR 54.4(b) without a change in configuration or properties ("passive"), and are not subject to replacement based on a qualified life or specified time period ("long-lived") [10 CFR 54.21(a)(1)(i) and (ii)].

2.4.3 Review Procedures

For each area of review, the following review procedures are to be followed:

2.4.3.1 Structural Components Subject to Aging Management Review

For each of the plant level structures within the scope of license renewal, an applicant should identify those "passive," "long-lived" structural components that have intended functions. For example, the applicant may identify that its auxiliary building is within the scope of license renewal. For this auxiliary building, the applicant may identify the structural components of beams, concrete walls, blowout panels, etc., are subject to an aging management review. The reviewer should focus on such a structure, one at a time, to confirm that the "passive," "long-lived" structural components that have intended functions have been identified by the applicant.

The reviewer should use the plant Updated Final Safety Analysis Report (UFSAR), orders, applicable regulations, exemptions, and license conditions to determine the design basis for the structures and structural components. The design basis determines the structure's intended function(s), which in turn, determines the structural components within that structure that are required for the structure to perform its intended function.

The reviewer should focus the review on those structural components that are not identified as being within the scope of license renewal. For example, for a building within the scope of license renewal, if an applicant did not identify the building roof as subject to an aging management review, the reviewer should verify that this particular roof has no intended functions, such as a "Seismic II over I" concern in accordance with the plant's CLB. The reviewer should not review structural components that have been identified as subject to an aging management review by the applicant because the applicant has the option of including more structural components than the rule requires to be subject to an aging management review.

Further, the reviewer should select functions described in the UFSAR to verify that structural components having intended functions were not omitted from the scope of the rule. For example, if the UFSAR indicates that a dike within the fire pump house prevents a fuel oil fire from spreading to the electrically driven fire pump, the reviewer should verify that this dike has been identified as within the scope of license renewal.

Only structural components that are "passive" and "long-lived" are subject to aging management review. Table 2.1-5 of Section 2.1 of this standard review plan is provided for the reviewer to assist in identifying whether certain structures and structural components are "passive." Applicant should justify omitting a structure or structural component that is within the scope of license renewal at their facility and is listed as "passive" on Table 2.1-5.

The applicant should also identify the structural components intended functions. Table 2.1-4 in Section 2.1 of this standard review plan provides typical "passive" structural component intended functions.

The reviewer should find no omissions of structural components subject to aging management review by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the structural components subject to an aging management review.

The staff has developed additional scoping/screening guidance. For example, there are some structural components that may be grouped together as a commodity, such as pipe hangers, and there are some structural components that are considered consumable materials, such as sealants. Additional guidance on these and others are contained in Section 2.1 of this standard review plan for the following:

- commodity groups
- complex assemblies
- hypothetical failure
- cascading
- consumables
- heat exchanger intended functions
- multiple functions
- piece-parts

Table 2.4-1 provides examples of structural components scoping/screening lessons learned from the review of initial license renewal applications and basis for disposition.

2.4.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provision of this review plan section and that the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that there is a reasonable assurance that the applicant has appropriately identified the structural components subject to an aging management review to meet the requirements stated in 10 CFR 54.21(a)(1).

2.4.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specific portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

2.4.6 References

None.

Table 2.4-1. Examples of Structural Components Scoping/Screening and Basis for Disposition

Example	Disposition
Turbine building roof	An applicant indicates that degradation or loss of its turbine building roof will not result in the loss of any intended functions. The turbine building contains safety-related systems, structures, and components in the basement, which would remain sheltered and protected by several reinforced concrete floors if the turbine building roof was to degrade. Because this roof does not perform an intended function, it is not within the scope of license renewal.
Post-tensioned containment tendon gallery	The intended function of the post-tensioning system is to impose compressive forces on the concrete containment structure to resist the internal pressure resulting from a design-basis accident with no loss of structural integrity. Although the tendon gallery is not relied on to maintain containment integrity during design basis events, operating experience indicates that water infiltration and high humidity in the tendon gallery can contribute to a significant aging effect on the vertical tendon anchorages that could potentially result in loss of the ability of the post-tensioning system to perform its intended function. However, containment inspections provide reasonable assurance that the aging effects of the tendon anchorages, including those in the gallery, will continue to perform their intended functions. Because the tendon gallery does not perform an intended function, it is not within the scope of license renewal.
Water-stops	Ground water in-leakage into the auxiliary building could occur as a result of degradation to the water-stops. This leakage may cause flooding of equipment within the scope of license renewal. (The plant's UFSAR discusses the effects of flooding.) The water-stops perform their functions without moving parts or change in configuration and they are not typically replaced. Thus, the water-stops are subject to an aging management review. However, they need not be called out explicitly in the scoping/screening results if they are included as parts of structural components that are subject to an aging management review.

2.5 SYSTEM SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROLS

Review Responsibilities

Primary - Branch responsible for electrical and Instrumentation and Controls engineering
Secondary - None

2.5.1 Areas of Review

This review plan section addresses the electrical and instrumentation and controls (I&C) scoping and screening results for license renewal. Typical electrical and I&C components consist of the following: electrical penetrations, electrical cables and connections, motors, diesel generators, air compressors, pressure transmitters, pressure indicators, water level indicators, switchgear, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies.

An applicant is required by 10 CFR 54.21(a)(1) to identify and list structures and components subject to an aging management review. These are "passive," "long-lived" structures and components that are within the scope of license renewal. In addition, an applicant is required by 10 CFR 54.21(a)(2) to describe and justify methods used to identify these structures and components. The staff reviews the applicant's methodology separately following the guidance in Section 2.1 of this standard review plan. To verify that the applicant has properly implemented its methodology, the staff focuses its review on the implementation results to confirm that there is no omission of electrical and I&C components that are subject to an aging management review.

An applicant would list all plant level systems and structures. Based on the Design Basis Events (DBEs) in the plant's current licensing basis (CLB) and other CLB information relating to non-safety-related systems and structures and certain regulated events, the applicant would identify those plant level systems and structures within the scope of license renewal, as defined in 10 CFR 54.4(a). This is "scoping" of the plant level systems and structures for license renewal. The staff reviews the applicant's plant level "scoping" results separately following the guidance in Section 2.2 of this standard review plan.

For an electrical and I&C system that is within the scope of license renewal, an applicant would not identify the specific electrical and I&C components that are subject to an aging management review. For example, an applicant would not "tag" each specific length of cable that is "passive," "long-lived," and performs an intended function as defined in 10 CFR 54.4(b). Instead, an applicant would use the so-called "plant spaces" approach (Ref. 1). The "plant spaces" approach provides efficiencies in aging management review of electrical equipment located within the same plant space environment.

Under the "plant spaces" approach, an applicant would identify all "passive," "long-lived" electrical equipment within a specified plant space as subject to an aging management review, regardless of whether these components perform any intended functions. For example, an applicant could identify all "passive," "long-lived" electrical equipment located within the turbine building ("plant space") to be subject to an aging management review for license renewal. In

the subsequent aging management review, the applicant would evaluate the environment of the turbine building to determine the appropriate aging management activities for these equipment. The applicant has options to further refine this encompassing scope on an as-needed basis. For the above example, if the applicant identified elevated temperatures in a particular area within the turbine building, the applicant may elect to identify only those "passive," "long-lived" electrical equipment that perform an intended function in this particular area as subject to an aging management review.

10 CFR 54.21(a)(1)(i) provides many examples of electrical and I&C components that are not considered to be "passive" and are not subject to an aging management review for license renewal. Therefore, an applicant is expected to identify only a few electrical and I&C components, such as electrical penetrations, cables, and connections, that are "passive" and subject to an aging management review. However, the time-limited aging analysis (TLAA) evaluation requirements in 10 CFR 54.21(c) apply to environmental qualification (EQ) of electrical equipment that is not limited to "passive."

An applicant has the flexibility to determine the set of structures and components for which an aging management review is performed, provided that this set encompasses the structures and components for which the Commission has determined an aging management review is required. This is based on the statements of consideration for the license renewal rule (60 FR 22478). Therefore, the reviewer should not review components that the applicant has identified as subject to an aging management review, because it is an applicant's option to include more components than those required by 10 CFR 54.21(a)(1).

The following areas relating to the methodology implementation results for the electrical and I&C systems are reviewed:

2.5.1.1 Components Within the Scope of License Renewal

The applicant's identification of electrical and I&C system components that are within the scope of license renewal is reviewed. (Scoping)

2.5.1.2 Components Subject to an Aging Management Review

The applicant's identification of electrical and I&C system components within the scope of license renewal that are "passive" and "long-lived." (Screening)

2.5.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(a)(1). For the applicant's implementation of its methodology in 10 CFR 54.21(a)(2) to be acceptable, the staff should find no omission of electrical and I&C system components that are subject to an aging management review.

2.5.2.1 Components Within the Scope of License Renewal

Electrical and I&C components are within the scope of license renewal as delineated in 10 CFR 54.4(a) if they are:

1. Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49(b)(1)) to ensure the following functions --

   (i) The integrity of the reactor coolant pressure boundary;

   (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

   (iii) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in 10 CFR 50.34(a)(1) or 10 CFR 100.11, as applicable.

2. All non-safety related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in 1. above.

3. All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

2.5.2.2 Components Subject to Aging Management Review

Electrical and I&C components are subject to an aging management review if they are within the scope of license renewal and perform an intended function as defined in 10 CFR 54.4(b) without moving parts or without a change in configuration or properties ("passive"), and are not subject to replacement based on a qualified life or specified time period ("long-lived") (10 CFR 54.21(a)(1)(i) and (ii)).

2.5.3 Review Procedures

The reviewer should verify that an applicant has identified in the license renewal application the electrical and I&C components that are subject to an aging management review for its plant. The review procedures are presented below assuming an applicant has performed "scoping" and "screening" of electrical and I&C system components in that sequence. However, an applicant may elect to perform "screening" before "scoping" and that is acceptable because, regardless of the sequence, the end result should encompass the electrical and I&C components that are subject to an aging management review.

The scope of 10 CFR 50.49 electric equipment to be included within 10 CFR 54.4(a)(3) is that "long-lived" (qualified life of 40-years or greater) equipment already identified by licensees under 10 CFR 50.49(b) which specifies certain electric equipment important to safety. Licensees may rely upon their listing of EQ equipment, as required by 10 CFR 50.49(d), for

purposes of satisfying 10 CFR 54.4(a)(3) with respect to equipment within the scope of 10 CFR 50.49 (60 FR 22466). However, the license renewal rule has a requirement (10 CFR 54.21(c)) on the evaluation of TLAAs, including EQ (10 CFR 50.49). EQ equipment is not limited to "passive." An applicant may identify EQ equipment separately for TLAA evaluation and not include them as equipment subject to an aging management review under 10 CFR 54.21(a)(1). The EQ equipment identified for TLAA evaluation would encompass the "passive" EQ equipment subject to an aging management review. The TLAA evaluation would ensure that the EQ equipment would be functional for the period of extended operation. The staff reviews the applicant's EQ TLAA evaluation separately following the guidance in Section 4.4 of this standard review plan.

For each area of review, the following review procedures are to be followed:

2.5.3.1 Components Within the Scope of License Renewal

This step determines whether the applicant has properly identified the components within the scope of license renewal. The reviewer should review selected components that the applicant did not identify as within the scope of license renewal to verify that they did not omit components with intended functions.

The reviewer should use the plant Updated Final Safety Analysis Report (UFSAR), orders, applicable regulations, exemptions, and license conditions to determine the design basis for the systems, structures, and components. The design basis determines the system intended function(s), which in turn, determines the components within that system that are required for the system to perform its intended function(s).

An applicant may use the "plant spaces" approach in scoping electrical and I&C components for license renewal. In the "plant spaces" approach, an applicant may indicate that all electrical and I&C components located within a particular plant area ("plant space"), such as the containment and auxiliary building, are within the scope of license renewal. The applicant may also indicate that all electrical and I&C components located within a particular plant area ("plant space"), such as the warehouse, are not within the scope of license renewal. Table 2.5-1 contains some examples of this "plant spaces" approach and the corresponding review procedures.

An applicant would use the "plant spaces" approach for the subsequent aging management review of the electrical and I&C components. The applicant would evaluate the environment of the "plant spaces" to determine the appropriate aging management activities for these equipment. The applicant has options to further refine this encompassing scope on an as-needed basis. For example, if the applicant identified elevated temperatures in a particular area within a building ("plant space"), the applicant may elect to identify only those "passive," "long-lived" electrical and I&C components that perform an intended function in this particular area as subject to an aging management review. This approach to further narrow the "plant spaces" is consistent with the "plant spaces" approach. In this case, the reviewer verifies that the applicant has specifically identified the electrical and I&C components that are within the scope of license renewal in these narrow "plant spaces." The reviewer should verify that the electrical and I&C components that the applicant has elected to further exclude indeed do not have any intended functions as defined in 10 CFR 54.4(b).

The reviewer should find no omissions of components within the scope of license renewal by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the components within the scope of license renewal for the electrical and I&C systems.

Section 2.1 of this standard review plan contains additional guidance on scoping the following:

- commodity groups
- complex assemblies
- scoping events
- hypothetical failure
- cascading

At the completion of this review step, the reviewer has confidence that the applicant's identification has encompassed all electrical and I&C components within the scope of license renewal.

2.5.3.2 Component Subject to an Aging Management Review

This step determines whether the applicant has properly identified the components subject to an aging management review from among those identified in the previous step, that is, Subsection 2.5.3.1 of this review plan section. The reviewer should review selected components that the applicant has identified as within the scope of license renewal to verify that the applicant has identified these components as subject to an aging management review if they perform intended functions without moving parts or without a change in configuration or properties and are not subject to replacement on the basis of a qualified life or specified time period. The description of "passive" may also be interpreted to include structures and components that do not display "a change in state."

Only components that are "passive" and "long-lived" are subject to an aging management review. Table 2.1-2 of Section 2.1 of this standard review plan is provided for the reviewer to assist in identifying whether certain components are "passive." The reviewer should verify that electrical and I&C components identified as "passive" in Table 2.1-2 of Section 2.1 of this standard review plan have been included by the applicant as subject to an aging management review, as appropriate. An applicant should justify omitting a component that is within the scope of license renewal at their facility and is listed as "passive" in Table 2.1-2.

The reviewer should find no omissions of components subject to an aging management review by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the components subject to an aging management review for the electrical and I&C systems.

Section 2.1 of this standard review plan contains additional guidance on screening of the following:

- consumables
- multiple intended functions
- piece-parts

At the completion of this review step, the reviewer has confidence that the applicant has identified the "passive," "long-lived" components subject to an aging management review.

2.5.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provision of this review plan section and that the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that there is a reasonable assurance that the applicant has appropriately identified the electrical and instrumentation and controls system components subject to an aging management review to meet the requirements stated in 10 CFR 54.21(a)(1).

2.5.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specific portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

2.5.6 References

1. SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants-Electrical Cable and Terminations," Sandia National Laboratories, September 1996, page 6-11.

Table 2.5-1. Examples of "Plant Spaces" Approach for Electrical and I&C Scoping and Corresponding Review Procedures

Example	Review Procedures
An applicant indicates all electrical and I&C components on site are within the scope of license renewal.	This is acceptable and a staff review is not necessary, because all electrical and I&C components are included without exception and would encompass those required by the rule.
An applicant indicates all electrical and I&C components located in 7 specific buildings (containment, auxiliary building, turbine building, etc.) are within the scope of license renewal.	The reviewer should review in areas outside of these 7 buildings ("plant spaces"). The reviewer should verify that the applicant has included any direct-buried cables in trenches between these building as within the scope of license renewal if they perform an intended function. The reviewer should also select buildings other than the 7 specific building (for example, the radwaste facility), to verify that they do not contain any electrical and I&C components that perform any intended functions.
An applicant indicates that all electrical and I&C components located on site, except for the 525kV switchyard, 230kV transmission lines, radwaste facility, and 44kV substation, are within the scope of license renewal.	The reviewer should select the specifically excluded "plant spaces" (that is, the 525kV switchyard, 230kV transmission lines, radwaste facility, and 44kV substation) to verify that they do not contain any electrical and I&C components that perform any intended functions.
An applicant indicates that all electrical and I&C components associated with the systems specifically identified as within the scope of license renewal are themselves within the scope of license renewal.	This is not strictly the "plant spaces" approach for scoping. The applicant should provide marked-up electrical one-line drawings identifying those system components that are within the scope of license renewal. The reviewer should review the UFSAR to select electrical and I&C components that the applicant did not identify as within the scope of the rule to verify that they do not perform any intended functions as defined in 10 CFR 54.4(b). For example, if an applicant indicates that all electrical and I&C components of the reactor protection system are within the scope of license renewal, the reviewer should review drawings to verify that all reactor protection system electrical and I&C components have been included. The reviewer should also verify that electrical and I&C components not identified as within the scope of license renewal do not perform an intended function associated with the reactor protection system.

3.2 AGING MANAGEMENT OF REACTOR COOLANT SYSTEM

Review Responsibilities

Primary - Branch responsible for materials and chemical engineering
Secondary - Branch responsible for mechanical engineering

3.2.1 Areas of Review

This review plan section addresses the aging management review of the Reactor Coolant System for license renewal. For a recent vintage plant, the information related to the Reactor Coolant System is contained in Chapter 5, "Reactor Coolant System and Connected Systems," of the plant's Final Safety Analysis Report (FSAR) consistent with the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) (Ref. 1). The Reactor Coolant System consists of the reactor vessel and internals and, for BWRs, the reactor coolant recirculation system and portions of other systems connected to the pressure vessel extending to the first isolation valve outside of containment or to the first anchor point. These connected systems include residual heat removal, low-pressure core spray, high-pressure core spray, low-pressure coolant injection, high-pressure coolant injection, reactor core isolation cooling, isolation condenser, reactor coolant cleanup, feedwater, and main steam. For PWRs, the Reactor Coolant System includes the primary coolant loop, the pressurizer and pressurizer relief tank, and the steam generators. The connected systems for PWRs include the residual heat removal or low-pressure injection system, core flood spray or safety injection tank, chemical and volume control system or high-pressure injection system, and sampling system.

The staff has issued a Generic Aging Lessons Learned (GALL) report addressing aging management for license renewal (Ref. 2). The GALL report documents generically the staff's basis for determining when existing programs are adequate to manage aging without change and when existing programs should be augmented for license renewal. The GALL report may be referenced in a license renewal application and should be treated in the same manner as an approved topical report.

Because a license renewal applicant may or may not be able to reference the GALL report, the following areas are reviewed:

3.2.1.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

The staff should not repeat its review of the matters described in the GALL report and should find it acceptable when the GALL report is referenced in a license renewal application. However, the staff should ensure that the material presented in the GALL report is applicable to the specific plant involved. The staff should also verify that the applicant has identified specific programs as described and evaluated in the GALL report.

3.2.1.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report provides the basis for identifying those programs that warrant further evaluation during the staff review of a license renewal application. The staff review focus should be on augmented programs for license renewal.

3.2.1.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

The GALL report provides a generic staff evaluation of certain aging management programs. If an applicant does not rely on a particular program for license renewal, or if the applicant indicates that the generic staff evaluation of the elements of a particular program does not apply to its plant, the staff should review the applicant's aging management programs.

3.2.1.4 Components or Aging Effects that Are Not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of certain components and aging effects. If an applicant has identified particular components subject to aging management review for its plant, or if the applicant has identified particular aging effects for a component that are not addressed in the GALL report, the staff should review the applicant's aging management programs.

3.2.1.5 FSAR Supplement

The FSAR supplement summarizing the programs and activities for managing the effects of aging for the period of extended operation is reviewed.

3.2.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21.

3.2.2.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

Acceptable methods for managing aging of the Reactor Coolant System are described and evaluated in Chapter IV of the GALL report (Ref. 2). In referencing the GALL report, an applicant should indicate that the material presented in the GALL report is applicable to the specific plant involved and provide the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. An applicant may reference appropriate programs as described and evaluated in the GALL report.

3.2.2.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report indicates that further evaluation should be performed for:

3.2.2.2.1 Cumulative Fatigue Damage

The management of fatigue of components in the pressure vessel and internals, reactor coolant pressure boundary (BWR), reactor coolant system and connected lines (PWR), and steam generators should be further evaluated. Fatigue is a time-limited aging analysis (TLAA) and is discussed in detail in Section 4.3 of this standard review plan.

3.2.2.2.2 Changes in Dimension due to Void Swelling

The management of changes in dimension due to void swelling for pressure vessel internal components should be further evaluated.

3.2.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

The management of loss of fracture toughness due to neutron embrittlement for pressure vessel and internal components should be further evaluated. Neutron embrittlement is a TLAA to be evaluated for the period of license renewal, and its treatment is discussed in detail in Section 4.2 of this standard review plan.

3.2.2.2.4 Crack Initiation and Growth due to Stress Corrosion Cracking

The management of crack initiation and growth due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC) of BWR reactor vessel components and internals, and reactor coolant pressure boundary components should be further evaluated. Enhanced inservice inspection and plant-specific evaluations are recommended, and the corrective action proposed by the BWRVIP is under staff review for certain components.

The management of crack initiation and growth due to SCC and IGSCC of PWR reactor vessel components and internals, reactor coolant system and connected lines, and steam generator components should be further evaluated. The GALL report recommends that a susceptibility study of all Ni-base alloys be performed to identify the most susceptible locations, enhanced inspections as necessary, the development of a plant-specific aging management program for certain cast austenitic stainless steels (CASS) components, a review of the primary system water chemistry to identify any primary system resin bed intrusions that exceed the PWR primary water chemistry guidelines, and a plant-specific evaluation of the vessel flange leak detection line. For steam generator tubes, sleeves, and plugs, the GALL report concludes that no further evaluation is necessary provided applicable aging management programs are followed and the plant technical specifications conform to the EPRI inspection guidelines and NEI 97-06 (Ref. 3).

3.2.2.2.5 Crack Initiation and Growth due to Irradiation-Assisted Stress Corrosion Cracking

The management of crack initiation and growth due to irradiation-assisted stress corrosion cracking (IASCC) of PWR reactor vessel internals (all designs) should be further evaluated. The GALL report recommends enhanced inservice inspection to supplement visual VT-3 techniques for tight cracks.

3.2.2.2.6 Loss of Preload due to Stress Relaxation

The management of loss of preload due to stress relaxation of PWR reactor vessel internals (all designs) should be further evaluated. The GALL report recommends enhanced inservice inspection to supplement visual VT-3 techniques for tight cracks.

3.2.2.2.7 Wall Thinning due to Erosion

The management of wall thinning due to erosion of BWR reactor coolant pressure boundary components and steam generator components and PWR reactor coolant system and connected lines should be further evaluated. The GALL report recommends that further plant-specific information be developed to demonstrate that the CHECWORKS computer code can be effectively used in the applicant's flow-accelerated corrosion program to manage wall thinning. For erosion/corrosion of tube support lattice bars in Combustion Engineering design steam

generators, the aging management program is plant-specific and should be evaluated on an individual plant basis. The management of wall thinning due to erosion in PWR pressurizer spray heads is plant-specific and should be evaluated on an individual plant basis.

3.2.2.2.8 Crack Initiation and Growth due to Unanticipated Thermal and Mechanical Loading

The management of crack initiation and growth due to unanticipated thermal and mechanical loading of PWR reactor coolant system and connected lines should be further evaluated. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that significant degradation is not occurring and that the component's intended function will be maintained during the period of extended operation.

3.2.2.2.9 Loss of Material Due to Pitting and Crevice Corrosion

The management of loss of material due to pitting and crevice corrosion of steam generator pressure boundary components should be further evaluated. The existing aging management program relies on inservice inspection to detect degradation caused by this aging mechanism. However, based on NRC Information Notice 90-04 (Ref. 4), the ASME Section XI inservice inspection requirements may not be sufficient to differentiate isolated cracks from inherent geometric conditions where general corrosion pitting of the pressure vessel shell exists, and the existing program should be augmented to enhance the effectiveness of the inspection procedures.

3.2.2.2.10 Loss of Material due to Attrition and Wear

The management of loss of material due to attrition and wear of the pressurizer heater sheaths and sleeves should be further evaluated. The aging management program is plant-specific and should be evaluated on an individual plant basis.

3.2.2.2.11 Quality Assurance for Aging Management of Non-Safety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1, Appendix A.2 of this standard review plan.

3.2.2.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.2.2.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.2.2.5 FSAR Supplement

The summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should provide appropriate description

such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the integrated plant assessment regarding the bases for determining that aging effects are managed during the period of extended operation.

3.2.3 Review Procedures

For each area of review, the following review procedures are to be followed:

3.2.3.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in its license renewal application, as appropriate. The staff should not repeat its review of the matters described in the GALL report. The staff should find it acceptable when the GALL report is referenced in a license renewal application, if the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. The reviewer verifies that the applicant has provided a brief description of the system, components, materials, and environment, and has stated that the particular plant is bounded by the GALL report. The reviewer also verifies that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience had been reviewed by the applicant and are bounded by the GALL report. The reviewer verifies that the applicant has identified those aging effects for the Reactor Coolant System components that are contained in the GALL report as applicable to its plant. The reviewer reviews any outliers identified by the applicant.

The applicant may state that certain aging management programs and the staff evaluation, as described in the GALL report, are applicable to its plant. The reviewer verifies that the applicant has identified the appropriate programs as described and evaluated in the GALL report. Programs evaluated in the GALL report regarding the Reactor Coolant System Components are tabulated in Table 3.2-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

3.2.3.2 Further Evaluation of Aging Management as Recommended by the GALL Report

3.2.3.2.1 Cumulative Fatigue Damage

Fatigue of components in the pressure vessel and internals, reactor coolant pressure boundary (BWR), reactor coolant system and connected lines (PWR), and steam generators is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. The staff should review the evaluation of this TLAA separately, following the guidance in Section 4.3 of this standard review plan.

3.2.3.2.2 Changes in Dimension due to Void Swelling

The reviewer verifies that the applicant has proposed a program to manage changes in dimension due to void swelling in the pressure vessel internal components.

3.2.3.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

Neutron embrittlement is a TLAA to be evaluated for the period of license renewal for all ferritic materials that have a neutron fluence of greater than 10^{17} n/cm^2 (E > 1 MeV) at the end of the

license renewal term. The staff should review the evaluation of this TLAA separately, following the guidance in Section 4.2 of this standard review plan.

3.2.3.2.4 Crack Initiation and Growth due to Stress Corrosion Cracking

The reviewer reviews the applicant's augmented program to manage crack initiation and growth due to SCC and IGSCC of BWR reactor vessel components and internals, and reactor coolant pressure boundary components. Aging management programs for the BWR reactor vessel include inservice inspection, materials selection for resistance to SCC, and coolant water chemistry control. However, the GALL report recommends enhanced inservice inspection to supplement visual techniques for the vessel shell attachment welds. For the vessel shell and beltline welds and the control rod drive housing, the corrective action proposed by the BWRVIP is under staff review. The aging management program for the vessel flange leak detection line is plant specific and requires evaluation on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced inservice inspection procedure is indicated and the applicant's use of corrective actions proposed by the BWRVIP guidelines are consistent with the findings of the staff review of that document.

Aging management programs for the BWR reactor vessel internals and coolant pressure boundary components include inservice visual and ultrasonic inspections (where accessible) and coolant water chemistry control. However, the GALL report notes that component inspection and flaw evaluation are to be performed in accordance with BWRVIP guidelines, as approved by the NRC staff, and the corrective action proposed by the BWRVIP is presently under staff review. The reviewer reviews the applicant's proposed programs to ensure that the applicant's use of corrective actions proposed by the BWRVIP guidelines are consistent with the findings of the staff review of that document.

The reviewer reviews the applicant's augmented program to manage crack initiation and growth due to SCC and IGSCC of PWR reactor vessel components and internals, reactor coolant system and connected lines, and steam generator components. Aging management programs for the PWR reactor vessel include inservice inspection and coolant water chemistry control. However, the GALL report states that the susceptibility of Ni-base alloys to primary water SCC under the anticipated service conditions has not been adequately addressed, particularly when demineralizer resins contaminate the reactor coolant system. The report recommends that the applicant perform a susceptibility study of all Ni-base alloys to identify the most susceptible locations and to determine whether an augmented inspection program, including a combination of surface and volumetric examination, is necessary. The aging management program for the vessel flange leak detection line is plant specific and requires evaluation on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that the GALL report recommendations for susceptibility studies and augmented inspection of Ni-base alloys are effectively implemented and that an effective enhanced plant-specific program for the management of crack initiation and growth due to SCC in the vessel flange leak detection line is defined.

Aging management programs for the PWR reactor vessel internals (all designs) include inservice inspection and coolant water chemistry control. However, the GALL report recommends enhanced inservice inspection to supplement visual techniques for regions that are difficult to inspect visually. These include creviced regions and the junctures of bolt head and shanks. The aging management program for the baffle/former bolts (Westinghouse design) is plant specific and requires evaluation on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that the GALL report recommendations on enhanced

inspection procedures for the required regions are effectively implemented and that an effective enhanced plant-specific program for the management of crack initiation and growth due to SCC in baffle/former bolts is defined.

Aging management programs for the PWR reactor coolant system and connected lines include inservice inspection, materials selection for resistance to SCC, and coolant water chemistry control. However, the GALL report states that a plant-specific aging management program will be required for CASS components to which the water chemistry guidelines do not apply and which do not meet the carbon and ferrite content criteria of NUREG-0313, Rev. 2 (Ref. 5). This program will include (a) adequate inspection methods to ensure detection of cracks, and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement. The GALL report states that the susceptibility of Ni-base alloys to primary water SCC under the anticipated service conditions has not been adequately addressed, particularly when demineralizer resins contaminate the reactor coolant system. The report recommends that the applicant perform a susceptibility study of all Ni-base alloys in this system to identify the most susceptible locations and to determine whether an augmented inspection program, including a combination of surface and volumetric examination, is necessary. The reviewer reviews the applicant's proposed programs to ensure that the GALL report recommendations on an effective plant-specific program for the management of SCC in the indicated CASS components is implemented. The reviewer also verifies that effective susceptibility studies and augmented inspection of Ni-base alloys are implemented as recommended by the GALL report.

Aging management programs for the steam generator vessel instrument and drain nozzles include inservice inspection, leak testing, and coolant water chemistry control. However, the GALL report states that the susceptibility of Ni-base alloys to primary water SCC under the anticipated service conditions has not been adequately addressed, particularly when demineralizer resins contaminate the reactor coolant system. The report recommends that the applicant review the primary system water chemistry to identify any primary system resin bed intrusions that exceed the PWR primary water chemistry guidelines. From this, the applicant should determine if an augmented inspection program is necessary. The reviewer reviews the applicant's proposed programs to verify that the applicant has properly reviewed the primary system water chemistry to identify any primary system resin bed intrusions exceeding the PWR primary water chemistry guidelines, and that the applicant has developed an effective augmented inspection program where necessary.

Aging management programs for controlling PWSCC and ODSCC in steam generator tubes, sleeves, and plugs include inservice inspections in accordance with Plant Technical Specifications, EPRI document "PWR Steam Generator Examination Guidelines, Rev. 5" (Ref. 6), NEI 97-06 (Ref. 3), and NRC Regulatory Guide (RG) 1.83 (Ref. 7). Tube repairs should be in accordance with NRC RG 1.121 (Ref. 8), Generic Letter 95-05 (Ref. 9), or other approved bases. The GALL report concludes that no further evaluation is necessary provided the above aging management programs are followed and the plant technical specifications conform to the EPRI inspection guidelines and NEI 97-06 (Ref. 3). The reviewer reviews the applicant's proposed programs to verify that the above aging management programs are followed and that the plant technical specifications conform to the EPRI inspection guidelines and NEI 97-06.

Aging management programs for controlling SCC and IGSCC in once-through steam generator upper and lower tube sheets and primary nozzles and safe ends include inservice inspections, guidelines to avoid sensitization of the stainless steel cladding, and primary water chemistry guidelines. However, the GALL report notes that ASME Section XI requires inservice inspection of only the welds and weld regions and does not address the potential for cladding cracking

remote from the welds. For the primary nozzles and safe ends, based on NRC Information Notices 90-10 (Ref. 10) and 90-30 (Ref. 11), the applicant should review Ni-alloy applications in primary coolant and implement an augmented inspection program and evaluate transducers for ultrasonic inspection of dissimilar metal welds. The reviewer reviews the applicant's program to verify that these recommendations for review and augmented inspection are effectively implemented.

3.2.3.2.5 Crack Initiation and Growth due to Irradiation-Assisted Stress Corrosion Cracking

The reviewer reviews the applicant's augmented program to manage crack initiation and growth due to IASCC of PWR reactor vessel internals. Aging management programs for the PWR reactor vessel internals (all designs) include inservice inspection (VT-3 visual inspection) and coolant water chemistry control. However, the GALL report recommends enhanced inservice inspection to supplement visual VT-3 techniques for the detection of tight cracks. These include an enhanced VT-1 technique to achieve 0.0005-in. resolution or supplemental UT inspections. As an alternative to enhanced inspection, a component-specific evaluation may be performed that includes a mechanical loading assessment to determine the maximum tensile loading on the component during ASME Code Level A, B, C, and D conditions. The aging management program for the baffle/former bolts (Westinghouse design) is plant specific and requires evaluation on an individual plant basis. The reviewer reviews the applicant's proposed programs to verify that enhanced inservice inspection or a component-specific evaluation of susceptible components has been effectively implemented and that an effective plant-specific aging management program for the baffle/former bolts has been defined.

3.2.3.2.6 Loss of Preload due to Stress Relaxation

The reviewer reviews the applicant's augmented program to manage loss of preload due to stress relaxation of PWR reactor vessel internal components (all designs). The aging management program consists of inservice inspection (VT-3 visual inspection) to detect cracks that are produced from the excessive vibration that results from a loss of preload. However, the GALL report notes that, since this technique can only detect degradation that occurs after the loss of preload, it is adequate only if there is sufficient redundancy that the loss of some components (e.g., bolts) between inspections is acceptable. The report also notes that VT-3 may not be sufficient to detect tight cracks and that creviced regions are difficult to inspect visually. Supplemental inspection by UT or other techniques may be required, particularly for inaccessible regions. The reviewer reviews the applicant's proposed programs to verify that, where required, an effective enhanced inservice inspection program has been effectively implemented to ensure that tight cracks and cracks in inaccessible regions are detected.

3.2.3.2.7 Wall Thinning due to Erosion

The reviewer reviews the applicant's augmented program to manage wall thinning due to erosion of BWR reactor coolant pressure boundary components and steam generator components. The aging management program consists of implementation of NRC Generic Letter 89-08 (Ref. 12), the CHECWORKS computer code, and EPRI guidelines of NSAC-202L-R2 (Ref. 13). The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer-term action. Technical aspects of the CHECWORKS Code, including the parameters and inputs, are acceptable. However, the EPRI guidance document NSAC-202L-R2 is too general to ensure

the applicant's flow-accelerated corrosion program will be effective in managing aging in safety-related systems. This guidance requires further evaluation. For erosion/corrosion of tube support lattice bars in Combustion Engineering design steam generators, the aging management program is plant-specific and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to verify that procedures have been developed in sufficient detail to ensure the effective use of the CHECWORKS Code and that an effective plant-specific aging management program for erosion/corrosion of tube support plate lattice bars is implemented.

The aging management program for wall thinning due to erosion of the pressurizer spray head in the PWR reactor coolant system is plant-specific and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to verify that an effective plant-specific aging management program has been developed.

3.2.3.2.8 Crack Initiation and Growth due to Unanticipated Thermal and Mechanical Loading

The reviewer reviews the applicant's augmented program to manage crack initiation and growth due to unanticipated thermal and mechanical loading of PWR reactor coolant system and connected lines. The aging management program consists of inservice inspection, leak testing, and water chemistry controls. However, the GALL report notes that ASME Section XI does not require volumetric inspection of pipes less than 4 in. in diameter. A plant-specific destructive examination or a nondestructive examination that permits inspection of the inside surfaces of the piping should be conducted to ensure that cracking has not occurred. A one-time inspection of a sample of locations most susceptible to cracking should be conducted to verify that service-induced weld cracking is not occurring in the small-bore piping, including fittings and branch connections. The reviewer reviews the applicant's program to ensure that an effective one-time inspection of the inside surfaces of susceptible small-diameter piping locations has been implemented.

3.2.3.2.9 Loss of Material Due to Pitting and Crevice Corrosion

The reviewer reviews the applicant's augmented program to manage loss of material due to pitting and crevice corrosion of steam generator pressure boundary components. The existing aging management program consists of inservice inspection in accordance with ASME Section XI and water chemistry controls. However, the GALL report notes that, based on NRC Information Notice 90-04 (Ref. 4), where general corrosion pitting of the pressure vessel shell exists, the ASME Section XI inservice inspection requirements may not be sufficient to differentiate isolated cracks from inherent geometric conditions, and additional inspection procedures may be required. The existing program should be augmented to verify the effectiveness of the detection measures.

3.2.3.2.10 Loss of Material due to Attrition and Wear

The reviewer reviews the applicant's augmented program to manage loss of material due to attrition and wear of the pressurizer heater sheaths and sleeves. The aging management program is plant-specific and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to verify that an effective plant-specific aging management program has been developed.

3.2.3.2.11 Quality Assurance for Aging Management of Non-Safety-Related Components

An applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, for non-safety-related components that are subject to an aging management review for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address the associated program elements. If an applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If an applicant chooses other alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.2.3.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.2.3.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.2.3.5 FSAR Supplement

The reviewer verifies that the applicant's FSAR supplement for aging management of the Reactor Coolant System for license renewal is consistent with Table 3.2-2 of this review plan section. The reviewer also verifies that the applicant has provided FSAR supplement for Subsection 3.2.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.2.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section using a format similar to that in Table 3.2-2.

3.2.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has demonstrated that the aging effects associated with the Reactor Coolant System will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the current licensing basis during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the Reactor Coolant System.

3.2.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

3.2.6 References

1. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 1981.

2. NUREG-xxxx, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, XXXX.

3. NEI 97-06, "Steam Generator Program Guidelines," Nuclear Energy Institute, December 1997.

4. NRC Information Notice 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," U.S. Nuclear Regulatory Commission, January 26, 1990.

5. NUREG-0313, Rev. 2, "Technical Report on Material Selection and Processing Guidelines for BRW Coolant Pressure Boundary Piping, U.S. Nuclear Regulatory Commission, January 1988.

6. EPRI TR-107569-V1R5, "PWR Steam Generator Examination Guidelines, Rev. 5," Electric Power Research Institute September 1997.

7. NRC Regulatory Guide 1.83, "Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes," U.S. Nuclear Regulatory Commission, June 1974.

8. NRC Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes (for Comment)," U.S. Nuclear Regulatory Commission, May 1976.

9. NRC Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," U.S. Nuclear Regulatory Commission, August 3, 1995.

10. NRC Information Notice 90-10, "Primary Water Stress Corrosion Cracking (PWSCC) of Inconel 600," U.S. Nuclear Regulatory Commission, February 23, 1990.

11. NRC Information Notice 90-30, "Ultrasonic Inspection Techniques for Dissimilar Metal Welds," U.S. Nuclear Regulatory Commission, May 1, 1990.

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

13. NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program," Electric Power Research Institute.

Table 3.2-1. Aging Management Programs for Reactor Coolant System Evaluated in Chapter IV of the GALL Report

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR vessel components (except closure studs, vessel flange leak detection line, vessel intermediate and lower shell and beltline welds, CRD housing, and vessel attachment welds); BWR CASS recirculation pump and valve components	Crack initiation and growth from SCC and IGSCC	Inservice inspection; water chemistry	No
BWR vessel closure studs	Crack initiation and growth from SCC and IGSCC	Inservice inspection; minimization and control of SCC	No
BWR vessel flange leak detection line	Crack initiation and growth from SCC and IGSCC	Plant-specific AMP	Yes; plant-specific AMP (see Subsection 3.2.3.2.4)
BWR vessel intermediate and lower shell and beltline welds and control rod drive (CRD) mechanism housing; BWR piping and fittings	Crack initiation and growth from SCC and IGSCC	Inservice inspection; water chemistry; materials selection and processing to reduce susceptibility to sensitization	Yes; some applicable BWRVIP guidelines under staff review (see Subsection 3.2.3.2.4)
BWR vessel attachment welds	Crack initiation and growth from SCC and IGSCC	Inservice inspection; water chemistry	Yes; augmented inspection program may be required (see Subsection 3.2.3.2.4)
BWR internals (except core plate access hole cover and core shroud support structure)	Crack initiation and growth from SCC and IASCC	Inservice inspection; water chemistry	Yes; some applicable BWRVIP guidelines under staff review (see Subsection 3.2.3.2.4)

Table 3.2-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR core shroud head bolts	Crack initiation and growth from SCC	Inservice inspection; water chemistry	Yes; some applicable BWRVIP guidelines under staff review (see Subsection 3.2.3.2.4)
BWR core plate access hole cover and core shroud support structure	Crack initiation and growth from SCC and IASCC	Inservice inspection; water chemistry	No
PWR vessel components (except closure studs, vessel flange leak detection line, and CRD housing: Ni-base alloy components); PWR coolant system components (except CASS)	Crack initiation and growth from SCC and IGSCC	Inservice inspection; water chemistry	No
PWR vessel closure studs	Crack initiation and growth from SCC and IGSCC	Inservice inspection; minimization and control of SCC	No
PWR reactor coolant system and steam generator bolting	Crack initiation and growth from SCC and IGSCC	Bolting integrity program; inservice inspection	No
PWR vessel flange leak detection line and pressurizer spray head	Crack initiation and growth from SCC and IGSCC	Plant-specific AMP	Yes; plant-specific AMP (see Subsection 3.2.3.2.4)
PWR surge lines, nozzles and safe ends	Crack initiation and growth from SCC and IGSCC	Inservice inspection, water chemistry; and plant-specific AMP	Yes; plant-specific AMP (see Subsection 3.2.3.2.4)
PWR steam generator pressure boundary	Crack initiation and growth from SCC and IGSCC	Inservice inspection, materials selection	Yes; augmented inspection program may be required (see Subsection 3.2.3.2.4)

Table 3.2-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
PWR steam generator tubes and mechanical plugs	Crack initiation and growth from PWSCC, ODSCC, and IGA	Inservice inspection	No, provided Plant Tech. Specs conform to EPRI guidelines and NEI 97-06
PWR control rod drive (CRD) mechanism pressure housing, nozzle safe ends, core support pads, and vessel penetrations (Ni-base alloys)	Crack initiation and growth from SCC and IGSCC	Inservice inspection; water chemistry	Yes; Ni-base alloys may be susceptible to PWSCC (see Subsection 3.2.3.2.4)
PWR internals (except Westinghouse PWR baffle former bolts)	Crack initiation and growth from SCC and IASCC	Inservice inspection; water chemistry	Yes; augmented inspection program may be required (see Subsection 3.2.3.2.5)
Westinghouse PWR baffle former bolts	Crack initiation and growth from SCC and IASCC	Plant-specific AMP	Yes; plant-specific AMP (see Subsection 3.2.3.2.5)
PWR small-bore reactor coolant system piping	Crack initiation and growth from SCC and IGSCC	Inservice inspection; water chemistry	Yes; volumetric inspection not required for small-bore piping (see Subsection 3.2.3.2.4).
BWR isolation condenser components; PWR steam generator main steam piping and fittings	Loss of material from crevice and pitting corrosion	Inservice inspection; water chemistry	No
PWR steam generator (recirculation and once-through) upper and lower shell and transition cone	Loss of material from crevice and pitting corrosion	Inservice inspection; water chemistry	Yes; supplemental inservice inspection may be required (see Subsection 3.2.3.2.9)

Table 3.2-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
PWR steam generator tubes	Loss of material from general and pitting corrosion	Inservice inspection	No, provided Plant Tech. Specs conform to EPRI guidelines and NEI 97-06
PWR steam generator tubes	Deformation (denting) from corrosion at tube support plate intersections	Inservice inspection; water chemistry	No
PWR vessel components, piping, and fittings; pressurizer shell, heads, and integral support, pressurizer relief tank, steam generator pressure boundary and structural	Loss of material from boric acid wastage	Inservice inspection; Boric acid corrosion inspection	No
PWR reactor pump, valve, and pressurizer manway and flange closure bolting	Loss of material from boric acid wastage	Bolting integrity program; inservice inspection	No
BWR and PWR cast austenitic stainless steel (CASS) components	Loss of fracture toughness from thermal aging embrittlement	Thermal aging embrittlement monitoring program; inservice inspection	No
BWR jet pump assembly castings and orificed fuel support	Loss of fracture toughness from thermal aging embrittlement	Thermal aging embrittlement monitoring program; inservice inspection	No
Westinghouse PWR internals (except support plate and upper and lower support plate columns)	Loss of fracture toughness from neutron irradiation embrittlement	Inservice inspection	Yes; augmented inspection program may be required (see Subsection 3.2.3.2.3)

Table 3.2-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR vessel intermediate (beltline) shell and welds and LPCI nozzles	Loss of fracture toughness from neutron irradiation embrittlement	Inservice inspection; BWR surveillance program to be submitted	Yes; TLAA (see Subsection 3.2.3.2.3)
PWR vessel shell and nozzles	Loss of fracture toughness from neutron irradiation embrittlement	Irradiation embrittlement monitoring program	Yes; TLAA (see Subsection 3.2.3.2.3)
PWR pressure vessel cantilever/ column support and shield tank	Loss of fracture toughness from neutron irradiation embrittlement	Irradiation embrittlement monitoring program	No
ABB/Combustion Engineering PWR internals (except CEA shroud and core support column)	Loss of fracture toughness from neutron irradiation embrittlement	Inservice inspection	Yes; augmented inspection program may be required (see Subsection 3.2.3.2.3)
Babcock & Wilcox PWR internals (except CRA guide tube assemblies and CASS vent valve assembly)	Loss of fracture toughness from neutron irradiation embrittlement	Inservice inspection	Yes; augmented inspection program may be required (see Subsection 3.2.3.2.3)
Westinghouse PWR support plate and upper and lower support plate columns	Loss of fracture toughness from thermal aging and neutron irradiation embrittlement	Thermal aging and irradiation embrittlement monitoring programs; inservice inspection	No
ABB/Combustion Engineering PWR CEA shroud and core support column	Loss of fracture toughness from thermal aging and neutron irradiation embrittlement	Thermal aging and irradiation embrittlement monitoring programs; inservice inspection	No

Table 3.2-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
Babcock & Wilcox PWR CRA guide tube assemblies and CASS vent valve assembly	Loss of fracture toughness from thermal aging and neutron irradiation embrittlement	Thermal aging and irradiation embrittlement monitoring programs; inservice inspection	No
PWR internals	Changes in dimension from void swelling	Control of void swelling	Yes; control of void swelling (see Sub-section 3.2.3.2.2)
BWR recirculation pump and valve closure bolting	Loss of preload from stress relaxation	Bolting integrity program; inservice inspection	No
PWR reactor coolant system component and steam generator closure bolting	Loss of preload from stress relaxation	Bolting integrity program; inservice inspection	No
PWR internals	Loss of preload from stress relaxation	Inservice inspection	Yes; augmented inspection program may be required (see Subsection 3.2.3.2.6)
BWR piping and fittings; PWR steam generator components	Wall thinning from erosion/ corrosion	Erosion/ corrosion control program; water chemistry	Yes; guidance provided in NSAC-202L-R2 is too general to ensure that applicant's flow-accelerated corrosion program will be effective (see Subsection 3.2.3.2.7).
PWR steam generator tube support lattice bars	Loss of section thickness from erosion/ corrosion	Plant Tech. Specs.	Yes; plant-specific AMP (see Subsection 3.2.3.2.7)
PWR steam generator feedwater inlet ring and supports	Loss of material from erosion/ corrosion	Inservice inspection	No

Table 3.2-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
PWR steam generator secondary manways and handholes	Loss of material from erosion/ corrosion	Inservice inspection	No
PWR pressurizer spray head	Wall thinning from erosion	Plant Tech. Specs.	Yes; plant-specific AMP (see Subsection 3.2.3.2.7)
PWR steam generator feedwater impingement plate support	Loss of section thickness from erosion	Plant Tech. Specs.	Yes; plant-specific AMP (see Subsection 3.2.3.2.7)
BWR recirculation pump and valve seal flange and closure bolting	Loss of material from attrition and wear	Bolting integrity program; inservice inspection	No
PWR internals	Loss of material from attrition and wear	Inservice inspection	No
PWR reactor coolant system component closure bolting; steam generator bolting	Loss of material from attrition and wear	Bolting integrity program; inservice inspection	No
PWR vessel closure studs, and core support pads	Loss of material from attrition and wear	Inservice inspection; attrition and wear control program	No
PWR pressurizer heater sheaths and sleeves	Loss of material from attrition and wear	Plant Tech. Specs.	Yes; plant-specific AMP (see Subsection 3.2.3.2.10)
PWR steam generator tubes	Loss of material from fretting and wear	Inservice inspection	No, provided Plant Tech. Specs conform to EPRI guidelines and NEI 97-06
PWR small-bore reactor coolant system piping	Crack initiation and growth from unanticipated thermal and mechanical loading	Inservice inspection; water chemistry	Yes; volumetric inspection not required for small-bore piping (see Subsection 3.2.3.2.8).

Table 3.2-2. FSAR Supplement for Aging Management of Reactor Coolant System

Program	Description of Program	Implementation Schedule
Inservice inspection	The program consists of periodic visual inspection of external surfaces for signs of degradation, assessment, and corrective actions. This program is in accordance with ASME Section XI, as required in 10 CFR 50.55a.	Existing program
Materials selection and processing to reduce susceptibility to sensitization	This program consists of guidelines on materials, processes, and primary coolant chemistry to minimize and control IGSCC problems in austenitic stainless steel BWR piping in accordance with NUREG-3313, Rev. 2 and Regulatory Guides 1.43 and 1.44.	Existing program
Water chemistry program	To mitigate aging effects on component surfaces that are exposed to water as process fluid, chemistry programs are used to control water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion.	Existing program; BWRVIP guidelines are currently under staff review
One-time inspection	To verify the effectiveness of the chemistry program, one-time inspection of internal surfaces of carbon steel piping, valves, and related cooling system components using suitable techniques at the most susceptible locations is performed to ensure that significant corrosion is not occurring.	Program will be implemented by ...
Minimization and control of SCC	This program consists of the guidelines of Regulatory Guide 1.65 on materials selection, materials properties, inspection, and protection against corrosion to minimize and control SCC problems in low-alloy steel reactor vessel closure bolting.	Existing program
Fatigue monitoring program (FMP)	In order not to exceed the design limit on fatigue usage and the number of cycles, FMP monitors and tracks the number of critical thermal and pressure test transients, and monitors the cycles for the selected RCS components. The FPM will be modified to monitor a sample of components with high fatigue usage factors for the effects on the fatigue life.	Program will be modified by ...

Table 3.2-2. (cont'd.)

Program	Description of Program	Implementation Schedule
	The FMP will assess the effect of the effect of the environment using statistical correlation developed by Argonne National Laboratory (ANL) in NUREG/CR-5704.	
Bolting integrity program	This program consists of guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and installation of pressure-retaining bolting for nuclear applications, and enhanced inspection techniques. This program is in response to NRC Bulletin 82-02 and Generic Letter 91-17.	Existing program
Comprehensive reactor vessel surveillance program	Periodic testing of metallurgical surveillance samples is used to monitor the progress of neutron embrittlement of the reactor pressure vessel as a function of neutron fluence, in accordance with regulatory Guide 1.99, Rev. 2. The withdrawal schedule will be revised to provide neutron fluence data at a neutron fluence equal to or greater than the projected peak fluence at the end of the license renewal period.	The surveillance capsule withdrawal schedule will be revised by ...
Boric acid corrosion inspection	The program consists of (1) visual inspection of external surfaces that are potentially exposed to borated water for leaks, (2) timely discovery of leak path and removal of the boric acid residues, (3) assessment of the damage, and (4) follow up inspection for adequacy. This program is in response to NRC Generic Letter 88-05.	Existing program
Thermal aging embrittlement monitoring program	The program consists of (1) determination of the susceptibility of cast austenitic stainless steel components to thermal aging embrittlement, (2) accounting for the synergistic effects of thermal aging and neutron irradiation, and (3) implementing a supplemental examination program.	Existing program

Table 3.2-2. (cont'd.)

Program	Description of Program	Implementation Schedule
Irradiation embrittlement monitoring program	The program consists of fracture toughness and material surveillance program requirements in accordance with Regulatory Guide 1.99, Rev. 2, implemented through NRC Generic Letters 88-11 and 92-01.	Existing program
Control of void swelling	Plant-specific aging management program to be developed.	Program will be implemented by ...
Assessment of loss of preload due to stress relaxation	Enhanced inspection required to detect cracks produced by vibration that results from loss of preload.	Program will be implemented by ...
Erosion/ corrosion control program	The program consists of the following; (1) conduct appropriate analysis and baseline inspection, (2) determine extent of thinning and replace/repair components, and (3) perform follow up inspections to confirm or quantify and take longer-term corrective actions. This program is in response to NRC Generic Letter 89-08.	Program will be modified by ...
Attrition and wear control program	The program consists of design requirements and guidelines, frequent performance monitoring, and timely corrective action in accordance with Regulatory Guide 1.65	Existing program
Management of steam generator feedwater impingement plate support erosion	Plant-specific aging management program to be developed.	Program will be implemented by ...
Inservice inspection of steam generator tubes	The program consists of guidance on the equipment and procedures for the inservice eddy current inspection of steam generator tubes in accordance with Regulatory Guide 1.83, NEI 97-06 and the EPRI document "PWR Steam Generator Examination Guidelines, Revision 2."	Existing program

Table 3.2-2. (cont'd.)

Program	Description of Program	Implementation Schedule
Plugging and repair of steam generator tubes	The program consists of guidance on the criteria for the repair or plugging of flawed steam generator tubes in accordance with Regulatory Guide 1.121 and NRC Generic Letter 95-05.	Existing program
Management of steam generator feedwater impingement plate support erosion	Plant-specific aging management program to be developed.	Program will be implemented by ...
Quality assurance	The 10 CFR Part 50, Appendix B program provides for corrective actions, confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include non-safety-related structures and components that are subject to an aging management review for license renewal.	Program will be implemented by .....

3.3 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES

Review Responsibilities

Primary - Branch responsible for materials and chemical engineering
Secondary - Branch responsible for mechanical engineering

3.3.1 Areas of Review

This review plan section addresses the aging management review of the Engineered Safety Features for license renewal. For a recent vintage plant, the information related to the Engineered Safety Features is contained in Chapter 6, "Engineered Safety Features," of the plant's Final Safety Analysis Report (FSAR) consistent with the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) (Ref. 1). The Engineered Safety Features consist of containment spray (PWRs), standby gas treatment (BWRs), containment isolation components (BWRs and PWRs), emergency core cooling (BWRs and PWRs), and fan cooler (PWRs). The emergency core cooling system for BWRs consists of high-pressure coolant injection (HPCI), reactor core isolation cooling (RCIC), high-pressure core spray (HPCS), automatic depressurization (ADS), low-pressure core spray (LPCS), low-pressure coolant injection (LPCI) or residual heat removal (RHR), and containment spray (CSS). The emergency core cooling system for PWRs consists of core flood (CFS), residual heat removal (RHR) or shutdown cooling (SDS), high-pressure safety injection (HPSI), low-pressure safety injection (LPSI), lines to chemical and volume control system (CVCS), spent fuel pool (SFP) cooling, and emergency sump, HPSI and LPSI pumps, pump seal coolers, RHR heat exchanger, and refueling water tank.

The staff has issued a Generic Aging Lessons Learned (GALL) report addressing aging management for license renewal (Ref. 2). The GALL report documents generically the staff's basis for determining when existing programs are adequate to manage aging without change and when existing programs should be augmented for license renewal. The GALL report may be referenced in a license renewal application and should be treated in the same manner as an approved topical report.

Because a license renewal applicant may or may not be able to reference the GALL report, the following areas are reviewed:

3.3.1.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

The staff should not repeat its review of the matters described in the GALL report and should find it acceptable when the GALL report is referenced in a license renewal application. However, the staff should ensure that the material presented in the GALL report is applicable to the specific plant involved. The staff should also verify that the applicant has identified specific programs as described and evaluated in the GALL report.

3.3.1.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report provides the basis for identifying those programs that warrant further evaluation during the staff review of a license renewal application. The staff review focus should be on augmented programs for license renewal.

3.3.1.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

The GALL report provides a generic staff evaluation of certain aging management programs. If an applicant does not rely on a particular program for license renewal, or if the applicant indicates that the generic staff evaluation of the elements of a particular program does not apply to its plant, the staff should review the applicant's aging management programs.

3.3.1.4 Components or Aging Effects that Are Not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of certain components and aging effects. If an applicant has identified particular components subject to aging management review for its plant, or if the applicant has identified particular aging effects for a component, that are not addressed in the GALL report, the staff should review the applicant's aging management programs.

3.3.1.5 FSAR Supplement

The FSAR supplement summarizing the programs and activities for managing the effects of aging for the period of extended operation is reviewed.

3.3.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21.

3.3.2.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

Acceptable methods for managing aging of the Engineered Safety Features are described and evaluated in Chapter V of the GALL report (Ref. 2). In referencing the GALL report, an applicant should indicate that the material presented in the GALL report is applicable to the specific plant involved and provide the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. An applicant may reference appropriate programs as described and evaluated in the GALL report.

3.3.2.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report indicates that further evaluation should be performed for:

3.3.2.2.1 Cumulative Fatigue Damage

The management of fatigue of components in the emergency core cooling system piping and fittings, valves, and fan cooler components should be further evaluated. Fatigue is a time-limited aging analysis (TLAA) and is discussed in detail in Section 4.3 of this standard review plan.

3.3.2.2.2 Crack Initiation and Growth due to Stress Corrosion Cracking

The management of crack initiation and growth due to stress corrosion cracking (SCC) of the PWR containment spray chemical addition storage tank and PWR emergency core cooling safety injection tank and refueling water tank penetrations and nozzles should be further evaluated. A one-time inspection of representative locations most susceptible to SCC is recommended, and follow-up actions are to be based on the inspection results.

The management of crack initiation and growth due to SCC in the BWR standby gas treatment system electric heater housing should be further evaluated. The GALL report states that the methodology for the prevention and detection of degradation in this component is covered in plant-specific preventative maintenance and inspection programs. The GALL report recommends that these plant-specific programs be evaluated.

3.3.2.2.3 Loss of Material due to General Corrosion

The management of loss of material due to general corrosion of the BWR standby gas treatment system carbon steel components and the PWR fan cooler system cooling coils, fan components, and piping and fittings should be further evaluated. The GALL report states that the methodologies for the prevention and detection of degradation in these components are covered in the Plant Technical Specifications, with additional guidance from NRC Regulatory Guide 1.52 (Ref. 3) on humidity control for the standby gas treatment system components. The GALL report recommends that these plant-specific preventative maintenance and inspection programs be evaluated.

3.3.2.2.4 Local Loss of Material due to Pitting and Crevice Corrosion

The management of local loss of material from pitting and crevice corrosion of PWR containment spray system components (except header and spray nozzle system components), BWR and PWR emergency core cooling system components (except automatic depressurization system piping and fittings), and PWR containment system isolation valves (GALL item V.C.9) should be further evaluated. The existing aging management program relies on inservice inspection and water chemistry to mitigate and detect degradation. However, a one-time inspection of representative locations most susceptible to pitting and crevice corrosion is recommended, and follow-up actions are to be based on the inspection results.

The management of local loss of material from pitting and crevice corrosion of PWR containment header and spray nozzle system components, BWR and PWR containment isolation valves (GALL item V.C.10), BWR emergency core cooling automatic depressurization system piping and fittings, and BWR emergency core cooling header and spray nozzles system components should be further evaluated. The GALL report states that the methodologies for the prevention and detection of degradation in these components are covered in the Plant Technical Specifications. The GALL report recommends that these plant-specific preventative maintenance and inspection programs be evaluated.

The management of local loss of material from pitting and crevice corrosion of the BWR standby gas treatment system carbon steel components and the PWR fan cooler system cooling coils, fan components, and piping and fittings should be further evaluated. The GALL report states that the methodologies for the prevention and detection of degradation in these component are covered in the Plant Technical Specifications, with additional guidance from NRC Regulatory Guide 1.52 (Ref. 3) on humidity control for the standby gas treatment system components. The

GALL report recommends that these plant-specific preventative maintenance and inspection programs be evaluated.

3.3.2.2.5 Local Loss of Material due to Micribiologically Influenced Corrosion

The management of local loss of material due to microbiologically influenced corrosion of the PWR emergency core cooling system line to the emergency sump should be further evaluated. The GALL report states that the methodologies for the prevention and detection of degradation in these components are covered in the Plant Technical Specifications. The GALL report recommends that these plant-specific preventative maintenance and inspection programs be evaluated.

3.3.2.2.6 Wall Thinning due to Erosion/Corrosion

The management of wall thinning due to erosion of PWR emergency core cooling system lines and valve components should be further evaluated. The GALL report recommends that further plant-specific information be developed to demonstrate that the CHECWORKS computer code can be effectively used in the applicant's flow-accelerated corrosion program to manage wall thinning.

3.3.2.2.7 Changes in Properties due to Elastomer Degradation

The management of changes in properties due to elastomer degradation of BWR standby gas treatment system filter seals and containment isolation penetration seals should be further evaluated. The GALL report states that the methodologies for the prevention and detection of degradation in these components are covered in the Plant Technical Specifications. The GALL report recommends that these plant-specific preventative maintenance and inspection programs be evaluated.

3.3.2.2.8 Loss of Elasticity of Seal from Weathering

The management of loss of elasticity of seal from weathering in the PWR emergency core cooling system refueling water tank perimeter seal should be further evaluated. The GALL report states that the methodology for the prevention and detection of degradation in this component is covered in the Plant Technical Specifications. The GALL report recommends that the plant-specific preventative maintenance and inspection programs be evaluated.

3.3.2.2.9 Loss of Iodine Retention Capacity due to Moisture Absorption

The management of loss of iodine retention capacity due to absorption of moisture in the BWR standby gas treatment system charcoal absorber filter should be further evaluated. The GALL report states that the methodology for the prevention and detection of degradation in this component is covered in the Plant Technical Specifications. The GALL report recommends that the plant-specific preventative maintenance and inspection programs be evaluated.

3.3.2.2.10 Quality Assurance for Aging Management of Non-Safety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1, Appendix A.2 of this standard review plan.

3.3.2.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.2.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, AppendixA.1 of this standard review plan.

3.3.2.5 FSAR Supplement

The summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should provide appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the integrated plant assessment regarding the bases for determining that aging effects are managed during the period of extended operation.

3.3.3 Review Procedures

For each area of review, the following review procedures are to be followed:

3.3.3.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in its license renewal application, as appropriate. The staff should not repeat its review of the matters described in the GALL report. The staff should find it acceptable when the GALL report is referenced in a license renewal application, if the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. The reviewer verifies that the applicant has provided a brief description of the system, components, materials, and environment, and has stated that the particular plant is bounded by the GALL report. The reviewer also verifies that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience had been reviewed by the applicant and are bounded by the GALL report. The reviewer verifies that the applicant has identified those aging effects for the Engineered Safety Features components that are contained in the GALL report as applicable to its plant. The reviewer reviews any outliers identified by the applicant.

The applicant may state that certain aging management programs and the staff evaluation, as described in the GALL report, are applicable to its plant. The reviewer verifies that the applicant has identified the appropriate programs as described and evaluated in the GALL report. Programs evaluated in the GALL report regarding the Engineered Safety Features Components are tabulated in Table 3.3-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

3.3.3.2 Further Evaluation of Aging Management as Recommended by the GALL Report

3.3.3.2.1 Cumulative Fatigue Damage

Fatigue of components in the emergency core cooling system piping and fittings, valves, and fan cooler components is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. The staff should review the evaluation of this TLAA separately, following the guidance in Section 4.3 of this standard review plan.

3.3.3.2.2 Crack Initiation and Growth due to Stress Corrosion Cracking

The reviewer reviews the applicant's augmented program to manage crack initiation and growth due to SCC of the PWR containment spray chemical addition storage tank, the PWR emergency core cooling safety injection tank, and the refueling water tank penetrations and nozzles. Aging management programs for these components include inservice inspection and materials selection and processing to avoid sensitization and susceptibility to SCC. However, the GALL report recommends that a one-time inspection of representative locations most susceptible to SCC be conducted to ensure that significant degradation is not occurring and that the component intended function will be maintained during the period of extended operation. The selection of susceptible locations is to be based on the severity of conditions, the length of service, and the design margin. The inspection techniques may include visual, ultrasonic, and surface techniques, and follow-up actions are to be based on the inspection results.

The reviewer reviews the applicant's augmented program to manage crack initiation and growth due to SCC in the BWR standby gas treatment system electric heater housing. The aging management program for this component is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of crack initiation and growth due to SCC in the BWR standby gas treatment system electric heater housing.

3.3.3.2.3 Loss of Material due to General Corrosion

The reviewer reviews the applicant's augmented program to manage the loss of material due to general corrosion in the BWR standby gas treatment system carbon steel components. NRC Regulatory Guide 1.52 (Ref. 3) recommends that this system be maintained at a relative humidity of 70% or less to prevent condensation on the inner surfaces of the components. However, the specifics of the aging management program for these components is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of the loss of material due to general corrosion of the BWR standby gas treatment system carbon steel components.

The reviewer reviews the applicant's augmented program to manage the loss of material due to general corrosion in the PWR fan cooler system cooling coils, fan components, and piping and fittings. The aging management program for these components is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of general corrosion of the PWR fan cooler system cooling coils, fan components, and piping and fittings.

3.3.3.2.4 Local Loss of Material due to Pitting and Crevice Corrosion

The reviewer reviews the applicant's augmented program to manage the local loss of material due to pitting and crevice corrosion of PWR containment spray system components (except header and spray nozzle system components), BWR and PWR emergency core cooling system components (except automatic depressurization system piping and fittings), and PWR containment system isolation valves (GALL item V.C.9). Aging management programs for these components include inservice inspection and coolant water chemistry control. However, the GALL report recommends that a one-time inspection of representative locations most susceptible to pitting and crevice corrosion be conducted to ensure that significant degradation is not occurring and that the component intended function will be maintained during the period of extended operation. The selection of susceptible locations is to be based upon the severity of conditions, the length of service, and the design margin. The inspection techniques may include visual, ultrasonic, and surface techniques, and follow-up actions are to be based on the inspection results.

The reviewer reviews the applicant's augmented program to manage the local loss of material due to pitting and crevice corrosion of PWR containment header and spray nozzle system components, BWR and PWR containment isolation valves (GALL item V.C.10), BWR emergency core cooling automatic depressurization system piping and fittings, and BWR emergency core cooling header and spray nozzles system components. The aging management program for these components is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of local loss of material due to pitting and crevice corrosion of these components.

The reviewer reviews the applicant's augmented program to manage the local loss of material due to pitting and corrosion in the BWR standby gas treatment system carbon steel components. NRC Regulatory Guide 1.52 (Ref. 3) recommends that this system be maintained at a relative humidity of 70% or less to prevent condensation on the inner surfaces of the components. However, the specifics of the aging management program for these components are given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of pitting and crevice corrosion of the BWR standby gas treatment system carbon steel components.

The reviewer reviews the applicant's augmented program to manage the local loss of material due to pitting and crevice corrosion in the PWR fan cooler system cooling coils, fan components, and piping and fittings. The aging management program for these components is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of local loss of material due to pitting and crevice corrosion of the PWR fan cooler system cooling coils, fan components, and piping and fittings.

3.3.3.2.5 Local Loss of Material due to Micribiologically Influenced Corrosion

The reviewer reviews the applicant's augmented program to manage the local loss of material due to microbiologically influenced corrosion of the PWR emergency core cooling system line to

the emergency sump. The aging management program for this component is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of local loss of material due to microbiologically influenced corrosion of the PWR emergency core cooling system line to the emergency sump.

3.3.3.2.6 Wall Thinning due to Erosion/Corrosion

The reviewer reviews the applicant's augmented program to manage wall thinning due to erosion/corrosion of the PWR emergency core cooling system lines and valve components. The aging management program consists of implementation of NRC Generic Letter 89-08 (Ref. 4), the CHECWORKS computer code, and EPRI guidelines of NSAC-202L-R2 (Ref. 5). The program includes the following recommendations: (a) conduct appropriate analysis and limited baseline inspection, (b) determine the extent of thinning and repair/replace components, and (c) perform follow-up inspections to confirm or quantify and take longer-term action. Technical aspects of the CHECWORKS Code, including the parameters and inputs, are acceptable. However, the EPRI guidance document NSAC-202L-R2 is too general to ensure the applicant's flow-accelerated corrosion program will be effective in managing aging in safety-related systems.

3.3.3.2.7 Changes in Properties due to Elastomer Degradation

The reviewer reviews the applicant's augmented program to manage changes in properties due to elastomer degradation of BWR standby gas treatment system filter seals and containment isolation penetration seals. The aging management program for these components is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of changes in properties due to elastomer degradation of BWR standby gas treatment system filter seals and containment isolation penetration seals.

3.3.3.2.8 Loss of Elasticity of Seal from Weathering

The reviewer reviews the applicant's augmented program to manage loss of elasticity of seal from weathering in the PWR emergency core cooling system refueling water tank perimeter seal. The aging management program for this component is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of loss of elasticity from weathering in the PWR emergency core cooling system refueling water tank perimeter seal.

3.3.3.2.9 Loss of Iodine Retention Capacity due to Moisture Absorption

The reviewer reviews the applicant's augmented program to manage loss of iodine retention capacity due to absorption of moisture in the BWR standby gas treatment system charcoal absorber filter. The aging management program for this component is given in the Plant Technical Specifications and should be evaluated on an individual plant basis. The reviewer reviews the applicant's proposed programs to ensure that an effective enhanced plant-specific program is in place for the management of loss of iodine retention capacity from absorption of moisture in the BWR standby gas treatment system charcoal absorber filter.

3.3.3.2.10 Quality Assurance for Aging Management of Non-Safety-Related Components

An applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, for non-safety-related components that are subject to an aging management review for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address the associated program elements. If an applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If an applicant chooses other alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.3.3.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.3.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.3.5 FSAR Supplement

The reviewer verifies that the applicant's FSAR supplement for aging management of the Engineered Safety Features for license renewal is consistent with Table 3.3-2 of this review plan section. The reviewer also verifies that the applicant has provided FSAR supplement for Subsection 3.3.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.3.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section using a format similar to that in Table 3.3-2.

3.3.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has demonstrated that the aging effects associated with the Engineered Safety Features will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the current licensing basis during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the Engineered Safety Features.

3.3.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

3.3.6 References

1. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 1981.

2. NUREG-xxxx, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, XXXX.

3. Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Postaccident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants, Rev. 2," U.S. Nuclear Regulatory Commission, March 1978.

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

5. NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program," Electric Power Research Institute.

Table 3.3-1. Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL Report

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR emergency core cooling system and containment isolation components; PWR containment spray and emergency core cooling system components in contact with primary coolant	Crack initiation and growth from SCC	Inservice inspection; materials selection and processing to reduce susceptibility to sensitization; water chemistry	No
PWR containment spray chemical addition storage tank; PWR emergency core cooling safety injection tank and refueling water tank penetrations and nozzles	Crack initiation and growth from SCC	Inservice inspection; materials selection and processing to reduce susceptibility to sensitization	Yes; one-time inspection and appropriate follow-up actions recommended (see Subsection 3.3.3.2.2)
BWR standby gas treatment system electric heater housing	Crack initiation and growth from SCC	Plant Technical Specifications	Yes; plant-specific AMP (see Subsection 3.3.3.2.2)
Containment isolation coated carbon steel components	Loss of material from general corrosion	Inservice inspection; coatings program	No
BWR standby gas treatment system carbon steel components	Loss of material from general corrosion	Plant Technical Specifications; humidity control	Yes; plant-specific AMP (see Subsection 3.3.3.2.3)
PWR fan cooler system cooling coils, fan components, and piping and fittings	Loss of material from general corrosion	Plant Technical Specifications	Yes; plant-specific AMP (see Subsection 3.3.3.2.3)
PWR containment spray heat exchanger components and PWR and BWR emergency core cooling system heat exchanger and isolation condenser components	Local loss of material from pitting and crevice corrosion	Inservice inspection; performance testing; water chemistry	No

Table 3.3-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
PWR containment spray system components, BWR and PWR and emergency core cooling system components; BWR and PWR containment isolation valves	Local loss of material from pitting and crevice corrosion	Inservice inspection; water chemistry	Yes; one-time inspection and appropriate follow-up actions recommended (see Subsection 3.3.3.2.4)
PWR containment system components; BWR and PWR containment isolation com-ponents; BWR emergency core cooling system components	Local loss of material from general, pitting and crevice corrosion	Plant Technical Specifications	Yes; plant-specific AMP (see Subsec-tion 3.3.3.2.4)
BWR standby gas treatment system carbon steel components	Local loss of material from pitting and crevice corrosion	Plant Technical Specifications, humidity control	Yes; plant-specific AMP (see Subsec-tion 3.3.3.2.4)
PWR containment spray, containment isolation, and emergency core cooling system bolting and other external surfaces	Loss of material from boric acid wastage	Inservice inspection; boric acid corrosion prevention	No
PWR containment spray and BWR emergency core cooling system heat exchanger components	Loss of material from general and microbiologically influenced corrosion	Service water program; water chemistry	No
PWR emergency core cooling system line to emergency sump	Loss of material from micro-biologically influenced corrosion	Plant Technical Specifications	Yes; plant-specific AMP (see Subsec-tion 3.3.3.2.5)
PWR containment spray and BWR emergency core cooling system heat exchanger components	Buiildup of deposit from biofouling	Service water program; water chemistry	No

Table 3.3-1. (cont'd.)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
PWR emergency core cooling system lines and valve components	Wall thinning from erosion/ corrosion	Erosion/corrosion control program	Yes; guidance provided in NSAC-202L-R2 is too general to ensure that applicant's flow-accelerated corrosion program will be effective (see Subsection 3.3.3.2.6).
Containment isolation coated carbon steel components	Loss of material from attrition and wear	Inservice inspection; leakage tests; coatings program	No
BWR standby gas treatment system filter seals; containment isolation penetration seals	Changes in properties from elastomer degradation	Plant Technical Specifications	Yes; plant-specific AMP (see Subsection 3.3.3.2.7)
PWR emergency core cooling system refueling water tank perimeter seal	Loss of elasticity from weathering	Plant Technical Specifications	Yes; plant-specific AMP (see Subsection 3.3.3.2.8)
BWR standby gas treatment system charcoal absorber filter	Loss of iodine retention capacity from absorption of moisture	Plant Technical Specifications	Yes; plant-specific AMP (see Subsection 3.3.3.2.9)

Table 3.3-2. FSAR Supplement for Aging Management of Engineered Safety Features

Program	Description of Program	Implementation Schedule
Inservice inspection	The program consists of periodic volumetric, visual, and/or visual inspection for signs of degradation, assessment, and corrective actions. This program is in accordance with ASME Section XI, as required in 10 CFR 50.55a.	Existing program
Performance testing of heat exchangers	This program consists of testing the performance of heat exchanger components and assessing their operational readiness.	Existing program
Materials selection and processing to reduce susceptibility to sensitization	This program consists of guidelines on materials, processes, and primary coolant chemistry to minimize and control IGSCC problems in austenitic stainless steel BWR piping in accordance with NUREG-3313, Rev. 2 and Regulatory Guides 1.43 and 1.44.	Existing program
Water chemistry program	To mitigate aging effects on component surfaces that are exposed to water as process fluid, chemistry programs are used to control water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion.	Existing program; BWRVIP guidelines are currently under staff review
One-time inspection	To verify the effectiveness of the chemistry program, one-time inspection of internal surfaces of piping, valves, storage tanks, and related cooling system components using suitable techniques at the most susceptible locations is performed to ensure that significant corrosion is not occurring.	Program will be implemented by ...
Fatigue monitoring program (FMP)	In order not to exceed the design limit on fatigue usage and the number of cycles, FMP monitors and tracks the number of critical thermal and pressure test transients, and monitors the cycles for the selected RCS components. The FPM will be modified to monitor a sample of components with high fatigue usage factors for the effects on the fatigue life. The FMP will assess the effect of the effect of the environment using statistical correlation developed by Argonne National Laboratory (ANL) in NUREG/CR-5704.	Program will be modified by ...

Table 3.3-2. (cont'd.)

Program	Description of Program	Implementation Schedule
Boric acid corrosion inspection	The program consists of (1) visual inspection of external surfaces that are potentially exposed to borated water for leaks, (2) timely discovery of leak path and removal of the boric acid residues, (3) assessment of the damage, and (4) follow up inspection for adequacy. This program is in response to NRC Generic Letter 88-05.	Existing program
Erosion/ corrosion control program (safety-related systems)	The program consists of the following; (1) conduct appropriate analysis and baseline inspection, (2) determine extent of thinning and replace/repair components, and (3) perform follow up inspections to confirm or quantify and take longer-term corrective actions. This program is in response to NRC Generic Letter 89-08 and will be modified to address safety-related systems.	Program will be modified by ...
Coatings program	The program monitors the application of coatings for the prevention of general corrosion, including surface preparation, dry film thickness, and visual inspection of the coating. This program is in response to NRC Regulatory Guide 1.54.	Existing program
Humidity control program	The program provides guidelines on maintaining humidity levels at or below specified levels to prevent condensation on surfaces susceptible to corrosion. This program is in response to NRC Regulatory Guide 1.52.	Existing program
Service water program	The program assures that cooling water system is in compliance with General Design Criteria and Quality Assurance requirements. It consists of (a) surveillance and control of biofouling, (2) test program to verify heat transfer, (c) routine inspection and maintenance program, (d) system walkdown inspection, and (e) review of maintenance, operating, and training practices and procedures. This program is in response to NRC Generic Letter 89-13.	Existing program
Quality assurance	The 10 CFR Part 50, Appendix B program provides for corrective actions, confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include non-safety-related structures and components that are subject to an aging management review for license renewal.	Program will be implemented by ....

3.4 AGING MANAGEMENT OF AUXILIARY SYSTEMS

Review Responsibilities

Primary - Branch responsible for materials and chemical engineering
Secondary - Branch responsible for mechanical engineering

3.4.1 Areas of Review

This review plan section addresses the aging management review of the Auxiliary Systems for license renewal. For a recent vintage plant, the information related to the Auxiliary Systems is contained in Chapter 9, "Auxiliary Systems," of the plant's Final Safety Analysis Report (FSAR) consistent with the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) (Ref. 1). The Auxiliary Systems consist of systems such as new and spent fuel storage, spent fuel pool cooling and cleanup, cooling water, heating and ventilation, fire protection, diesel fuel oil, liquid waste disposal, for PWRs chemical and volume control, and coolant storage/refueling water, for BWRs suppression pool cleanup, standby liquid control, and shutdown cooling (old plants).

The aging management for portions of the chemical and volume control system for PWRs, and for BWRs, the standby liquid control, reactor water cleanup, and shutdown cooling (old plants) systems, extending up to the first isolation valve outside of containment is reviewed following the guidance in Section 3.2 of this standard review plan. The aging management for portions of the spent fuel pool cooling and cleanup, chemical and volume control system (PWR), and suppression pool cleanup and shutdown cooling systems (BWR), that are classified as Group B quality standard, is reviewed following the guidance in Section 3.3 of this standard review plan. The aging management program for the cooling towers is reviewed following the guidance in Section 3.6 of this standard review plan for "Group 6" structures.

The staff has issued a Generic Aging Lessons Learned (GALL) report addressing aging management for license renewal (Ref. 2). The GALL report documents generically the staff's basis for determining when existing programs are adequate to manage aging without change and when existing programs should be augmented for license renewal. The GALL report may be referenced in a license renewal application and should be treated in the same manner as an approved topical report.

Because a license renewal applicant may or may not be able to reference the GALL report, the following areas are reviewed:

3.4.1.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

The staff should not repeat its review of the matters described in the GALL report and should find it acceptable when the GALL report is referenced in a license renewal application. However, the staff should ensure that the material presented in the GALL report is applicable to the specific plant involved. The staff should also verify that the applicant has identified specific programs as described and evaluated in the GALL report.

3.4.1.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report provides the basis for identifying those programs that warrant further evaluation during the staff review of a license renewal application. The staff review focus should be on augmented programs for license renewal.

3.4.1.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

The GALL report provides a generic staff evaluation of certain aging management programs. If an applicant does not rely on a particular program for license renewal, or if the applicant indicates that the generic staff evaluation of the elements of a particular program does not apply to its plant, the staff should review the applicant's aging management programs.

3.4.1.4 Components or Aging Effects that Are Not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of certain components and aging effects. If an applicant has identified particular components subject to aging management review for its plant, or if the applicant has identified particular aging effects for a component, that are not addressed in the GALL report, the staff should review the applicant's aging management programs.

3.4.1.5 FSAR Supplement

The FSAR supplement summarizing the programs and activities for managing the effects of aging for the period of extended operation is reviewed.

3.4.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21.

3.4.2.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

Acceptable methods for managing aging of the Auxiliary Systems are described and evaluated in Chapter VIII of the GALL report (Ref. 2). In referencing the GALL report, an applicant should indicate that the material presented in the GALL report is applicable to the specific plant involved and provide the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. An applicant may reference appropriate programs as described and evaluated in the GALL report.

3.4.2.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report indicates that further evaluation should be performed for:

3.4.2.2.1 Loss of Material Due to General, Microbiologically Influenced, Galvanic, Pitting, and Crevice Corrosion

The management of loss of material due to general, crevice, and pitting corrosion of new fuel rack assembly; ducts, heating/ cooling coils, and piping in heating and ventilation systems; and piping, valve bodies, pump casing, and tanks in diesel fuel oil system should be further evaluated. The existing aging management program relies on protective coatings and periodic plant system walkdowns. The existence of a suitable aging management program should be evaluated.

The management of loss of material due to general, microbiologically influenced, pitting, and crevice corrosion of carbon steel piping, valve bodies, pump casing, tanks, and heat exchangers should be further evaluated. The existing aging management program relies on inservice inspection and preventive measures to mitigate corrosion by monitoring and control of water chemistry and using corrosion resistant materials and lining/coating. However, visual VT-2 examination during system leakage test may not be adequate to detect corrosion and the existing program should be augmented to verify the effectiveness of the program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

The management of loss of material due to general and pitting corrosion of carbon steel piping, valve bodies, and air accumulator and filter components in compressed air system should be further evaluated. The existing aging management program relies on frequent leak testing and preventive maintenance to check air quality. However, the existing program should be augmented to verify the effectiveness of the program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

The management of loss of material due to galvanic, pitting, and crevice corrosion of components in fire protection high-pressure service water system and reactor coolant pump oil collect system should be further evaluated because there is no generic existing aging management program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

The management of loss of material due to general, pitting, and crevice corrosion of piping, valve bodies, pump casing, tank, air accumulator, filter, and muffler in diesel generator starting air and combustion air systems should be further evaluated. The existing aging management program relies on regular maintenance, overhaul, and periodic inspection. The existence of a suitable aging management program should be evaluated.

The management of loss of material from general, microbiologically Influenced, pitting, and crevice corrosion, or buildup of deposit from biofouling of diesel fuel oil strainer and tank should be further evaluated. The existing aging management program consists of surveillance and maintenance procedures. However, the program does not ensure that degradation of tank internal surfaces has not occurred due to exposure to water,

biologics, and fungal. A one-time inspection of tank internal surfaces is an acceptable method to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

3.4.2.2.2 Cumulative Fatigue Damage

The management of fatigue of components in load handling and liquid waste disposal systems, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (BWR) should be further evaluated. Fatigue is a time-limited aging analysis (TLAA) and is discussed in detail in Section 4.3 of this standard review plan.

3.4.2.2.3 Loss of Elasticity of Seal from Weathering

The management of loss of elasticity from weathering of perimeter seal of tanks should be further evaluated because there is no generic existing aging management program. An inspection program should be implemented to ensure that caulking and sealant are intact and the component's intended function will be maintained during the period of extended operation.

3.4.2.2.4 Loss of Fracture Toughness from Thermal Embrittlement

The management of loss of fracture toughness from thermal embrittlement of valve bodies and pump casing in reactor water cleanup system (BWR) should be further evaluated because there is no generic existing aging management program. An acceptable method consists of (a) assessment of the susceptibility of cast austenitic stainless steel components to thermal aging embrittlement and (b) for susceptible components implement either a supplemental examination of the affected components as part of inservice inspection or a plant/component-specific evaluation to demonstrate that the thermally-embrittled material has adequate fracture toughness. The existence of a suitable aging management program should be evaluated to ensure that significant degradation is not occurring and that the component's intended function will be maintained during the period of extended operation.

3.4.2.2.5 Crack Initiation and Growth from Stress Corrosion Cracking (SCC)

The management of crack initiation and growth from SCC of stainless steel (SS) piping in spent fuel pool cooling and cleanup system and SS piping and tank penetrations in refueling water tank heating system should be further evaluated. The existing aging management program relies on inservice inspection and preventive measures to mitigate SCC by material selection and monitoring and control of reactor coolant water chemistry. However, visual VT-2 can not detect cracks and the existing program should be augmented to verify the effectiveness of the program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that significant SCC is not occurring and the component's intended function will be maintained during the period of extended operation.

The management of crack initiation and growth from SCC or intergranular stress corrosion cracking (IGSCC) of stainless steel piping, valve bodies, and pump casing in reactor water cleanup system (BWR) should be further evaluated. The existing aging management program relies on implementation of the IGSCC program. However, plants

that have complied with the actions associated with GL 89-10 on motor-operated valves may be exempt from inspection of the piping outboard of the containment isolation valves. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that significant SCC is not occurring and the component's intended function will be maintained during the period of extended operation.

The management of crack initiation and growth from SCC of the external surfaces adhered with electrical heat tracing of low-pressure SS piping and valves in chemical and volume control system (PWR) should be further evaluated. The existing aging management program relies on removal of corrosive adhesive and a periodic inspection of susceptible locations to ensure that significant SCC is not occurring and the component's intended function will be maintained during the period of extended operation. The existence of a suitable aging management program should be evaluated.

3.4.2.2.6 Loss of Material due to Attrition and Wear

The management of loss of material due to attrition and wear of the flexible collars and seals in heating and ventilation systems should be further evaluated because there is no generic existing aging management program. A plant-specific aging management program should be implemented to ensure that the component's intended function will be maintained during the period of extended operation.

3.4.2.2.7 Wall Thinning due to Erosion

The management of wall thinning due to erosion of the muffler in diesel generator combustion exhaust system should be further evaluated because there is no generic existing aging management program. A plant-specific aging management program should be implemented to ensure that the component's intended function will be maintained during the period of extended operation.

3.4.2.2.8 Quality Assurance for Aging Management of Non-Safety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1, Appendix A.2 of this standard review plan.

3.4.2.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.4.2.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.4.2.5 FSAR Supplement

The summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should provide

appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the integrated plant assessment regarding the bases for determining that aging effects are managed during the period of extended operation.

3.4.3 Review Procedures

For each area of review, the following review procedures are to be followed:

3.4.3.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in its license renewal application, as appropriate. The staff should not repeat its review of the matters described in the GALL report. The staff should find it acceptable when the GALL report is referenced in a license renewal application, if the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. The reviewer verifies that the applicant has provided a brief description of the system, components, materials, and environment, and has stated that the particular plant is bounded by the GALL report. The reviewer also verifies that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience had been reviewed by the applicant and are bounded by the GALL report. The reviewer verifies that the applicant has identified those aging effects for the Auxiliary Systems components that are contained in the GALL report as applicable to its plant. The reviewer reviews any outliers identified by the applicant.

The applicant may state that certain aging management programs and the staff evaluation, as described in the GALL report, are applicable to its plant. The reviewer verifies that the applicant has identified the appropriate programs as described and evaluated in the GALL report. Programs evaluated in the GALL report regarding the Auxiliary Systems Components are tabulated in Table 3.4-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

3.4.3.2 Further Evaluation of Aging Management as Recommended by the GALL Report

3.4.3.2.1 Loss of Material Due to General, Microbiologically Influenced, Galvanic, Pitting, and Crevice Corrosion

The reviewer reviews the applicant's proposed program to manage loss of material due to general, crevice, and pitting corrosion of new fuel rack assembly; ducts, heating/ cooling coils, and piping in heating and ventilation systems; and piping, valve bodies, pump casing, and tanks in diesel fuel oil system. The existing aging management program relies on protective coatings and periodic plant system walkdowns. The adequacy of the proposed program should be evaluated.

The reviewer reviews the applicant's augmented program to manage loss of material due to general, microbiologically influenced, pitting, and crevice corrosion of carbon steel piping, valve bodies, pump casing, tanks, and heat exchangers. The existing aging management program relies on inservice inspection and preventive measures to mitigate corrosion by monitoring and control of water chemistry and using corrosion

resistant materials and lining/coating. However, visual VT-2 examination during system leakage test may not be adequate to detect corrosion. The existing program should be augmented to verify the effectiveness of the program.

The reviewer reviews the applicant's augmented program to manage loss of material due to general and pitting corrosion of carbon steel piping, valve bodies, and air accumulator and filter components in compressed air system. The existing aging management program relies on frequent leak testing and preventive maintenance to check air quality. The existing program should be augmented to verify the effectiveness of the program.

The reviewer reviews the applicant's proposed program to manage loss of material due to galvanic, pitting, and crevice corrosion of components in fire protection high-pressure service water system and reactor coolant pump oil collection system.

The reviewer reviews the applicant's proposed program to manage loss of material due to general, pitting, and crevice corrosion of piping, valve bodies, pump casing, tank, air accumulator, filter, and muffler in diesel generator starting air and combustion air systems. The existing aging management program relies on regular maintenance, overhaul, and periodic inspection. The adequacy of the proposed program should be evaluated.

The reviewer reviews the applicant's augmented program to manage loss of material from general, microbiologically Influenced, pitting, and crevice corrosion, or buildup of deposit from biofouling of diesel fuel oil strainer and tank. The existing aging management program consists of surveillance and maintenance procedures. However, the program does not ensure that significant degradation of tank internal surfaces has not occurred. The existing program should be augmented to verify the effectiveness of the program.

The reviewer reviews the applicant's proposed augmented (or new) program to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation. If an applicant proposes a one-time inspection of select components and susceptible locations to ensure that significant corrosion is not occurring, the reviewer verifies that the applicant's selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. The reviewer also verifies that the proposed inspection would be performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques.

3.4.3.2.2 Cumulative Fatigue Damage

Fatigue of components in load handling and liquid waste disposal systems, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (BWR) is a TLAA to be performed for the period of license renewal. The staff should review the evaluation of this TLAA separately following the guidance in Section 4.3 of this standard review plan.

3.4.3.2.3 Loss of Elasticity of Seal from Weathering

The reviewer reviews the applicant's proposed program to manage loss of elasticity from weathering of perimeter seal of tanks. There is no generic existing aging management program. The reviewer verifies that the proposed program ensures that caulking and sealant are intact and the component's intended function will be maintained during the period of extended operation.

3.4.3.2.4 Loss of Fracture Toughness from Thermal Embrittlement

The management of loss of fracture toughness from thermal embrittlement of valve bodies and pump casing in reactor water cleanup system (BWR) should be further evaluated because there is no generic existing aging management program. An acceptable method consists of (a) assessment of the susceptibility of cast austenitic stainless steel components to thermal aging embrittlement and (b) for susceptible components implement either a supplemental examination of the affected components as part of inservice inspection or a plant/component-specific evaluation to demonstrate that the thermally-embrittled material has adequate fracture toughness. The existence of a suitable aging management program should be evaluated to ensure that significant degradation is not occurring and that the component's intended function will be maintained during the period of extended operation.

3.4.3.2.5 Crack Initiation and Growth from Stress Corrosion Cracking (SCC)

The reviewer reviews the applicant's augmented program to manage crack initiation and growth from SCC of SS piping in spent fuel pool cooling and cleanup system and SS piping and tank penetrations in refueling water tank heating system. The existing aging management program relies on inservice inspection and preventive measures to mitigate SCC by material selection and monitoring and control of reactor coolant water chemistry. However, visual VT-2 can not detect cracks. The existing program should be augmented to verify the effectiveness of the program.

The reviewer reviews the applicant's augmented program to manage crack initiation and growth from SCC or IGSCC of SS piping, valve bodies, and pump casing in reactor water cleanup system (BWR). The existing aging management program relies on implementation of the IGSCC program. However, some plants may be exempt from inspection of the piping outboard of the containment isolation valves. The existing program should be augmented to verify the effectiveness of the program.

The reviewer reviews the applicant's augmented program to manage crack initiation and growth from SCC of the external surfaces adhered with electrical heat tracing of low-pressure SS piping and valves in chemical and volume control system (PWR). The existing aging management program relies on removal of corrosive adhesive and a periodic inspection of susceptible locations. The existence of a suitable aging management program should be evaluated.

The reviewer reviews the applicant's proposed augmented program to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation. If an applicant proposes a one-time inspection of select components and susceptible locations to ensure that significant corrosion is not occurring, the reviewer verifies that the applicant's selection of

susceptible locations is based on severity of conditions, time of service, and lowest design margin. The reviewer also verifies that the proposed inspection would be performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques.

3.4.3.2.6 Loss of Material due to Attrition and Wear

The reviewer reviews the applicant's proposed program to manage loss of material due to attrition and wear of the flexible collars and seals in heating and ventilation systems. There is no generic existing aging management program. The reviewer verifies that the proposed program ensures that the component's intended function will be maintained during the period of extended operation.

3.4.3.2.7 Wall Thinning due to Erosion

The reviewer reviews the applicant's proposed program to manage wall thinning due to erosion of the muffler in diesel generator combustion exhaust system. There is no generic existing aging management program. The reviewer verifies that the proposed program ensures that the component's intended function will be maintained during the period of extended operation.

3.4.3.2.8 Quality Assurance for Aging Management of Non-Safety-Related Components

An applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, for non-safety-related components that are subject to an aging management review for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address the associated program elements. If an applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If an applicant chooses other alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.4.3.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.4.3.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.4.3.4 FSAR Supplement

The reviewer verifies that the applicant's FSAR supplement for aging management of the Auxiliary Systems for license renewal is consistent with Table 3.4-2 of this review plan section. The reviewer also verifies that the applicant has provided FSAR supplement for Subsection 3.4.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.4.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section using a format similar to that in Table 3.4-2.

3.4.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has demonstrated that the aging effects associated with the Auxiliary Systems will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the current licensing basis during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the Auxiliary Systems.

3.4.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

3.4.6 References

1. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 1981.

2. NUREG-xxxx, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, XXXX.

Table 3.4-1. Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
New fuel rack assembly; ducts, heating/ cooling coils, and piping in heating and ventilation systems; and piping, valve bodies, pump casing, and tanks in diesel fuel oil system	Loss of material due to general, pitting, and crevice corrosion; or attrition from wear	Plant system walkdown, protective coating	Yes, the existence of a suitable AMP should be evaluated (see Subsections 3.4.2.2.1 and 3.4.2.2.6)
Neutron absorbing sheets in spent fuel storage racks	Reduction in neutron absorbing capacity due to aging degradation	Neutron absorbing sheets monitoring program	No
Components in load handling and liquid waste disposal systems, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (BWR)	Cumulative fatigue damage	Components designed for fatigue in accordance with ASME or ANSI Codes	Yes; TLAA (see Subsection 3.4.2.2.2)
Load handling system structures, rails, and wire ropes	Loss of material from general corrosion and wear; or cracking and breaking of wire ropes due to degradation	Crane inspection program	No
Components in open–cycle and closed-cycle cooling water systems	Buildup of deposit from biofouling, and/or loss of material from general and microbio-logically influenced corrosion	Service water program	No

Table 3.4-1. (Continued)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
Carbon steel piping, valve bodies, pump casing, tanks, and heat exchangers	Loss of material from general and microbio-logically influenced corrosion, and selective leaching	Water chemistry, corrosion resistant lining or coating, inservice inspection	Yes, inspection of susceptible locations (see Subsection 3.4.2.2.1)
Carbon steel piping, valve bodies, and air accumulator and filter components in compressed air system	Loss of material due to general and pitting corrosion	Air quality monitoring program	Yes, inspection of susceptible locations (see Subsection 3.4.2.2.1)
Bolting and external surfaces of carbon steel components in PWRs	Loss of material from boric acid wastage	Boric acid corrosion program	No
Perimeter seal for tanks	Loss of elasticity of seal from weathering	No generic AMP	Yes, new program should be implemented (see Subsection 3.4.2.2.3)
Valve bodies and pump casing in reactor water cleanup system (BWR)	Loss of fracture toughness from thermal aging embrittlement	Assessment of embrittlement susceptibility and supplemental inservice inspection	Yes, the existence of a suitable AMP should be evaluated (see Subsection 3.4.2.2.4)
Stainless steel piping and tank penetrations in spent fuel pool cooling and cleanup system and refueling water tank heating system	Crack initiation and growth from SCC	Inservice inspection, material selection, water chemistry	Yes, visual examination can not detect cracks (see Subsection 3.4.2.2.5)
Stainless steel components in shutdown cooling and standby liquid control systems (BWR)	Crack initiation and growth from SCC	inservice inspection, material selection, water chemistry	No

Table 3.4-1. (Continued)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
External surfaces of low-pressure stainless steel piping and valves in chemical and volume control system (PWR)	Crack initiation and growth from SCC due to electrical heat tracing	Monitoring of heat-traced components	Yes; the existence of a suitable AMP should be evaluated (see Subsection 3.4.2.2.5)
Stainless steel piping, valve bodies, and pump casing in reactor water cleanup system (BWR)	Crack initiation and growth from SCC	IGSCC program	Yes, inspection of susceptible locations (see Subsection 3.4.2.2.5)
Closure bolting of reactor water cleanup and shutdown cooling system components (BWR)	Loss of material due to attrition and wear, or loss of preload from stress relaxation	Bolting integrity program	No
Fire rated doors	Loss of material due to attrition and wear	Fire protection program	No
Concrete fire barrier walls, ceilings, and floors	Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates, or loss of material due to corrosion of embedded steel	Fire protection program	No
Piping, filter, fire hydrants, mulsifier, pump casing, sprinkler, strainer, and valve bodies in high-pressure service water system for fire protection	Buildup of deposit from biofouling	Periodic performance and flush test of fire protection system	No

Table 3.4-1. (Continued)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
Piping, filter, fire hydrants, mulsifier, pump casing, sprinkler, strainer, and valve bodies in high-pressure service water system for fire protection	Loss of material due to general, microbio-logically influenced, pitting, and crevice corrosion	Fire protection program	No
Components in fire protection high-pressure service water system and reactor coolant pump oil collect system	Loss of material due to galvanic, pitting, and crevice corrosion	No generic AMP	Yes, one-time inspection (see Subsection 3.4.2.2.1)
Diesel-driven fire pump and fuel oil supply lines	Loss of material due to general, galvanic, pitting, and crevice corrosion	Fire protection program	No
Diesel fuel oil buried piping	Loss of material from general, galvanic, microbio-logically Influenced, pitting, and crevice corrosion	Corrosion protection of buried piping	No
Diesel fuel oil strainer and tank internal surfaces	Loss of material from general, microbio-logically Influenced, pitting, and crevice corrosion, or buildup of deposit from biofouling	Fuel oil surveillance and maintenance program	Yes, inspection of tank internal surfaces (see Subsection 3.4.2.2.1)

Table 3.4-1. (Continued)

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
Piping, valves, drain trap, air accumulator, filter, and muffler in diesel generator starting air and combustion air systems	Loss of material from general, pitting, and crevice corrosion	Diesel generator starting air and combustion air system monitoring	Yes; the existence of a suitable AMP should be evaluated (see Subsection 3.4.2.2.1)
Diesel engine combustion air exhaust muffler	Wall thinning due to erosion	No generic AMP	Yes, review plant-specific AMP (see Subsection 3.4.2.2.7)

Table 3.4-2. FSAR Supplement for Aging Management of Auxiliary Systems

Program	Description of Program	Implementation Schedule
Neutron absorbing sheets monitoring program	The program consists of periodic inspection of test coupons or actual panels, performing neutron attenuation testing, monitoring and analysis of silica or boride particles in the spent fuel pool, and corrective actions.	Existing program
Crane inspection program	The program consists of monthly inspection requirements of 29 CFR 1910.179(m) and the acceptance requirements of ASME B30.2.	Existing program
Service water program	The program provides assurance that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance requirements, and includes (a) surveillance and control of biofouling, (b) tests to verify heat transfer, (c) routine inspection and maintenance program, (d) system walkdown inspection, and (e) review of maintenance, operating, and training practices and procedures. This program is in response to NRC Generic Letter 89–13.	Existing program
Boric acid corrosion program	The program consists of (1) visual inspection of external surfaces that are potentially exposed to borated water for leaks, (2) timely discovery of leak path and removal of the boric acid residues, (3) assessment of the damage, and (4) follow up inspection for adequacy. This program is in accordance with GL 88-05.	Existing program
Inservice inspection	The program consists of periodic volumetric, surface, and/or visual examination of components and their supports for signs of degradation, assessment, and corrective actions. This program is in accordance with ASME Section XI, as required in 10 CFR 50.55a.	Existing program

Table 3.4-2. (Continued)

Program	Description of Program	Implementation Schedule
Water chemistry program	To mitigate aging effects on component surfaces that are exposed to water as process fluid, chemistry programs are used to control water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion.	Existing program
Material selection	This program consists of guidelines on materials and processes to minimize stress corrosion problems in austenitic stainless steel components. This program is in accordance with NUREG 0313, Rev. 2 (BWR), and NRC Regulatory Guides 1.43 and 1.44.	Existing program
Air quality monitoring	The program consists of improved system inspections, maintenance, and testing and includes frequent leak testing of carbon steel components, and preventive maintenance to check air quality. This program is in response to NRC Generic Letter 88-14.	Existing program
Thermal aging embrittlement monitoring program	The program consists of determination of the susceptibility of cast austenitic stainless steel components to thermal aging embrittlement, and for susceptible components implement either a supplemental examination program or a plant/component-specific evaluation to demonstrate that the material has adequate fracture toughness.	Program will be implemented by .....
Monitoring of heat-traced components	The program consists of preventive measures such as removal of corrosive adhesive and periodic inspection of susceptible locations.	Existing program
IGSCC program	The program includes guidance on materials, processes, water chemistry, weld overlay reinforcement, partial replacement, stress improvement of cracked weldments, clamping devices, crack characterization and repair, inspections methods and personnel, inspection schedules, sample expansion, leak detection, and reporting requirements. This program is in response to NRC Generic Letter 88-14.	Existing program

Table 3.4-2. (Continued)

Program	Description of Program	Implementation Schedule
Bolting integrity program	This program consists of guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and installation of pressure-retaining bolting for nuclear applications, and enhanced inspection techniques. This program is in response to NRC Bulletin 82–02 and Generic Letter 91–17.	Existing program
Corrosion protection of buried piping	The standard industry practices consist of preventive measures such as coating, wrapping, and cathodic protection, and surveillance to monitor the effectiveness of the coating and cathodic protection system.	Existing program
Fire protection program	General requirements include maintenance and testing of fire detection and suppression systems and surveillance procedures to ensure fire barriers are in place and fire suppression system and components are operable. This program is implemented in accordance with 10 CFR Part 50, Appendix R.	Existing program
Periodic performance and flush tests of fire protection system	To ensure no fouling has occurred in the fire protection system, periodic full flow flush test and system performance test are conducted to prevent buildup of deposits in components.	Existing program
Plant system walkdown	The program consists of periodic system walkdown to monitor degradation, evaluation of results, and corrective action as necessary.	Existing program
Protective coatings	As part of preventive measures to mitigate corrosion, components surfaces are protected with paint or coating.	Existing program

Table 3.4-2. (cont'd.)

Program	Description of Program	Implementation Schedule
One–time inspection	To verify the effectiveness of the chemistry program, one–time inspection of internal surfaces of carbon steel piping, valve bodies, pump casing, and tanks, except for the steam system and BWR feedwater system components, using suitable techniques at the most susceptible locations is performed to ensure that significant corrosion is not occurring.	Program will be implemented by .....
Quality assurance	The 10 CFR Part 50, Appendix B program provides for corrective actions, confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include non-safety-related structures and components that are subject to an aging management review for license renewal.	Program will be implemented by .....

3.5 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEM

Review Responsibilities

Primary - Branch responsible for materials and chemical engineering
Secondary - Branch responsible for mechanical engineering

3.5.1 Areas of Review

This review plan section addresses the aging management review of the Steam and Power Conversion System for license renewal. For a recent vintage plant, the information related to the Steam and Power Conversion System is contained in Chapter 10, "Steam and Power Conversion System," of the plant's Final Safety Analysis Report (FSAR) consistent with the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) (Ref. 1). The Steam and Power Conversion System consists of systems such as main steam, feedwater, condensate, steam generator blowdown (PWR), and auxiliary feedwater (PWR).

The aging management for portions of the main and extraction steam systems, feedwater system, and for PWRs, the auxiliary feedwater system, extending up to the first isolation valve outside of containment or to the first anchor point is reviewed following the guidance in Section 3.2 of this standard review plan.

The staff has issued a Generic Aging Lessons Learned (GALL) report addressing aging management for license renewal (Ref. 2). The GALL report documents generically the staff's basis for determining when existing programs are adequate to manage aging without change and when existing programs should be augmented for license renewal. The GALL report may be referenced in a license renewal application and should be treated in the same manner as an approved topical report.

Because a license renewal applicant may or may not be able to reference the GALL report, the following areas are reviewed:

3.5.1.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

The staff should not repeat its review of the matters described in the GALL report and should find it acceptable when the GALL report is referenced in a license renewal application. However, the staff should ensure that the material presented in the GALL report is applicable to the specific plant involved. The staff should also verify that the applicant has identified specific programs as described and evaluated in the GALL report.

3.5.1.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report provides the basis for identifying those programs that warrant further evaluation during the staff review of a license renewal application. The staff review focus should be on augmented programs for license renewal.

3.5.1.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

The GALL report provides a generic staff evaluation of certain aging management programs. If an applicant does not rely on a particular program for license renewal, or if the applicant indicates that the generic staff evaluation of the elements of a particular program does not apply to its plant, the staff should review the applicant's aging management programs.

3.5.1.4 Components or Aging Effects that Are Not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of certain components and aging effects. If an applicant has identified particular components subject to aging management review for its plant, or if the applicant has identified particular aging effects for a component that are not addressed in the GALL report, the staff should review the applicant's aging management programs.

3.5.1.5 FSAR Supplement

The FSAR supplement summarizing the programs and activities for managing the effects of aging for the period of extended operation is reviewed.

3.5.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21.

3.5.2.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

Acceptable methods for managing aging of the Steam and Power Conversion System are described and evaluated in Chapter VIII of the GALL report (Ref. 2). In referencing the GALL report, an applicant should indicate that the material presented in the GALL report is applicable to the specific plant involved and provide the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. An applicant may reference appropriate programs as described and evaluated in the GALL report.

3.5.2.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report indicates that further evaluation should be performed for:

3.5.2.2.1 Loss of Material Due to General, Crevice, and Pitting Corrosion

The management of loss of material due to general, crevice, and pitting corrosion of carbon steel piping, valve bodies, pump casing, and tanks, except for the steam system and BWR feedwater system components should be further evaluated. The existing aging management program relies on preventive measures to mitigate corrosion by monitoring and control of reactor coolant water chemistry. However, high concentrations of impurities at crevices and locations having stagnant flow could cause crevice and

pitting corrosion and the existing program should be augmented to verify the effectiveness of the mitigation measures. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

3.5.2.2.2 Quality Assurance for Aging Management of Non-Safety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1, Appendix A.2 of this standard review plan.

3.5.2.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.2.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.2.5 FSAR Supplement

The summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should provide appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the integrated plant assessment regarding the bases for determining that aging effects are managed during the period of extended operation.

3.5.3 Review Procedures

For each area of review, the following review procedures are to be followed:

3.5.3.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in its license renewal application, as appropriate. The staff should not repeat its review of the matters described in the GALL report. The staff should find it acceptable when the GALL report is referenced in a license renewal application, if the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. The reviewer verifies that the applicant has provided a brief description of the system, components, materials, and environment, and has stated that the particular plant is bounded by the GALL report. The reviewer also verifies that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience had been reviewed by the applicant and are bounded by the GALL report. The reviewer verifies that the applicant has identified those aging effects for the Steam

and Power Conversion System components that are contained in the GALL report as applicable to its plant. The reviewer reviews any outliers identified by the applicant.

The applicant may state that certain aging management programs and the staff evaluation, as described in the GALL report, are applicable to its plant. The reviewer verifies that the applicant has identified the appropriate programs as described and evaluated in the GALL report. Programs evaluated in the GALL report regarding the Steam and Power Conversion System Components are tabulated in Table 3.5-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

3.5.3.2 Further Evaluation of Aging Management as Recommended by the GALL Report

3.5.3.2.1 Loss of Material Due to General, Crevice, and Pitting Corrosion

The reviewer reviews the applicant's augmented program to manage loss of material due to general, crevice, and pitting corrosion of carbon steel piping, valve bodies, pump casing, and tanks, except for the steam system and BWR feedwater system components. The existing aging management program relies on preventive measures to mitigate corrosion by monitoring and control of water chemistry. However, high concentrations of impurities at crevices and locations having stagnant flow could cause crevice and pitting corrosion. The existing program should be augmented to verify the effectiveness of the mitigation measures.

The reviewer reviews the applicant's proposed program to ensure that significant corrosion is not occurring and the component's intended function will be maintained during the period of extended operation. If an applicant proposes a one-time inspection of select components and susceptible locations to ensure that significant corrosion is not occurring, the reviewer verifies that the applicant's selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. The reviewer also verifies that the proposed inspection would be performed in accordance with the requirements of ASME Code, 10CFR50 Appendix B, and ASTM standards, using a variety of nondestructive techniques including visual, ultrasonic, and surface techniques.

3.5.3.2.2 Quality Assurance for Aging Management of Non-Safety-Related Components

An applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, for non-safety-related components that are subject to an aging management review for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address the associated program elements. If an applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If an applicant chooses other alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.5.3.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.3.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.3.5 FSAR Supplement

The reviewer verifies that the applicant's FSAR supplement for aging management of the Steam and Power Conversion System for license renewal is consistent with Table 3.5-2 of this review plan section. The reviewer also verifies that the applicant has provided FSAR supplement for Subsection 3.5.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.5.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section using a format similar to that in Table 3.5-2.

3.5.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has demonstrated that the aging effects associated with the Steam and Power Conversion System will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the current licensing basis during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the Steam and Power Conversion System.

3.5.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

3.5.6 References

1. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 1981.

2. NUREG-xxxx, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, XXXX.

Table 3.5-1. Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL Report

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
Piping, valve bodies, and pump casings (carbon steel)	Wall thinning from erosion/ corrosion	Erosion/corrosion control program	No
BWR components in main steam lines to steam turbine	Loss of material from general, crevice, and pitting corrosion	Inservice inspection	No
Buried piping	Loss of material from general, galvanic, & microbiologically influenced corrosion	Corrosion protection of buried piping	No
PWR auxiliary feedwater system pumps and valves	Loss of material from general, crevice, and pitting corrosion	Inservice inspection; water chemistry; inservice testing	No
Carbon steel piping, valve bodies, pump casing, and tanks, except for the steam system and BWR feedwater system components	Loss of material from general, crevice, and pitting corrosion	Water chemistry	Yes, inspection of select components may be needed (see Subsection 3.5.2.2.1)
Heat exchanger	Loss of material from general and microbiologically influenced corrosion, and buildup of deposit from biofouling	Service water program; water chemistry	No
Oil coolers	Loss of material from general and microbiologically influenced corrosion, and buildup of deposit from biofouling	Service water program; monitoring oil contamination	No
Closure bolting	Attrition from wear	Bolting integrity program	No

Table 3.5-2. FSAR Supplement for Aging Management of Steam and Power Conversion System

Program	Description of Program	Implementation Schedule
Erosion/corrosion control program	The program consists of the following; (1) conduct appropriate analysis and baseline inspection, (2) determine extent of thinning and replace/repair components, and (3) perform follow up inspections to confirm or quantify and take longer-term corrective actions. This program is in response to NRC Generic Letter 89–08.	Existing program
Water chemistry program	To mitigate aging effects on component surfaces that are exposed to water as process fluid, chemistry programs are used to control water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion.	Existing program
Inservice inspection	The program consists of periodic volumetric, surface, and/or visual examination of components and their supports for signs of degradation, assessment, and corrective actions. This program is in accordance with ASME Section XI, as required in 10 CFR 50.55a.	Existing program
Bolting integrity program	This program consists of guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and installation of pressure-retaining bolting for nuclear applications, and enhanced inspection techniques. This program is in response to NRC Bulletin 82–02 and Generic Letter 91–17.	Existing program
Corrosion protection of buried piping	The standard industry practices consist of preventive measures such as coating, wrapping, and cathodic protection, and surveillance to monitor the effectiveness of the coating and cathodic protection system.	Existing program
Monitoring oil contamination	The program monitors water contamination in oil in accordance with standard test method of ASTM 95-83.	Existing program

Table 3.5-2. (cont'd.)

Program	Description of Program	Implementation Schedule
Service water program	The program provides assurance that cooling water system is in compliance with General Design Criteria and Quality Assurance requirements, and includes (a) surveillance and control of biofouling, (b) tests to verify heat transfer, (c) routine inspection and maintenance program, (d) system walkdown inspection, and (e) review of maintenance, operating, and training practices and procedures. This program is in response to NRC Generic Letter 89–13.	Existing program
Inservice testing	The program consists of periodic testing to assess the operational readiness of pumps, valves, and pressure relief devices. Corrective actions may consist of equipment disassembly, examination and maintenance. This program is in accordance with 10 CFR 50.55a.	Existing program
One–time inspection	To verify the effectiveness of the chemistry program, one–time inspection of internal surfaces of carbon steel piping, valve bodies, pump casing, and tanks, except for the steam system and BWR feedwater system components, using suitable techniques at the most susceptible locations is performed to ensure that significant corrosion is not occurring.	Program will be implemented by .....
Quality assurance	The 10 CFR Part 50, Appendix B program provides for corrective actions, confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include non-safety-related structures and components that are subject to an aging management review for license renewal.	Program will be implemented by .....

3.6 AGING MANAGEMENT OF STRUCTURES AND STRUCTURAL SUPPORTS

Review Responsibilities

Primary - Branch responsible for structural engineering
Secondary - None

3.6.1 Areas of Review

This review plan section addresses the aging management review of the structures and structural supports for license renewal. For a recent vintage plant, the information related to the structures and structural supports is contained in Chapter 3, "Design of Structures, Components, Equipment, and Systems," of the plant's Final Safety Analysis Report (FSAR) consistent with the Standard Review plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) (Ref. 1). The structures and structural supports consist of PWR and BWR containment structures, Class I structures, and component supports. The PWR containment structures consist of concrete (reinforced or prestressed) and steel containments. The BWR containment structures consist of Mark I concrete and steel containments, Mark II concrete (reinforced or prestressed) and steel containments, and Mark III concrete and steel containments.

The Class I structures are organized into nine groups: Group 1: BWR reactor building, PWR shield building, control room/building; Group 2: BWR reactor building with steel superstructure; Group 3: auxiliary building, diesel generator building, radwaste building, turbine building, switchgear room, auxiliary feedwater pump house, utility/piping tunnels; Group 4: containment interior, excluding refueling canal; Group 5: fuel storage facility, refueling canal; Group 6: water-control structures (intake structure, cooling tower, and spray pond); Group 7: concrete tanks; Group 8: steel tanks; and Group 9: BWR unit vent stack (Ref. 2).

The component supports are organized into six groups: Group B1.1: supports for ASME Class I piping and components; Group B1.2: supports for ASME Class 2, 3 and MC piping and components; Group B2: supports for cable tray, HVAC ducts, tube track, instrument tubing, non-ASME piping and components; Group B3: anchorage of racks, panels, cabinets, and enclosures for electric equipment and instrumentation; Group B4: supports for miscellaneous equipment (e.g., cranes, EDG, HVAC components); and Group B5: supports for miscellaneous steel structures (e.g., platforms, pipe whip restraints, jet impingement shields) (Ref. 2).

The staff has issued a Generic Aging Lessons Learned (GALL) report addressing aging management for license renewal (Ref. 2). The GALL report documents generically the staff's basis for determining when existing programs are adequate to manage aging without change and when existing programs should be augmented for license renewal. The GALL report may be referenced in a license renewal application and should be treated in the same manner as an approved topical report.

Because a license renewal applicant may or may not be able to reference the GALL report, the following areas are reviewed:

3.6.1.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

The staff should not repeat its review of the matters described in the GALL report and should find it acceptable when the GALL report is referenced in a license renewal application. However, the staff should ensure that the material presented in the GALL report is applicable to the specific plant involved. The staff should also verify that the applicant has identified specific programs as described and evaluated in the GALL report.

3.6.1.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report provides the basis for identifying those programs that warrant further evaluation during the staff review of a license renewal application. The staff review focus should be on augmented programs for license renewal.

3.6.1.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

The GALL report provides a generic staff evaluation of certain aging management programs. If an applicant does not rely on a particular program for license renewal, or if the applicant indicates that the generic staff evaluation of the elements of a particular program does not apply to its plant, the staff should review the applicant's aging management programs.

3.6.1.4 Components or Aging Effects that Are Not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of certain components and aging effects. If an applicant has identified particular components subject to aging management review for its plant, or if the applicant has identified particular aging effects for a component, that are not addressed in the GALL report, the staff should review the applicant's aging management programs.

3.6.1.5 FSAR Supplement

The FSAR supplement summarizing the programs and activities for managing the effects of aging for the period of extended operation is reviewed.

3.6.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21.

3.6.2.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

Acceptable methods for managing aging of the structures and structural supports are described and evaluated in Chapters II and III of the GALL report (Ref. 2). In referencing the GALL report, an applicant should indicate that the material presented in the GALL report is applicable to the specific plant involved and provide the information necessary

to adopt the finding of program acceptability as described and evaluated in the GALL report. An applicant may reference appropriate programs as described and evaluated in the GALL report.

3.6.2.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report indicates that further evaluation should be performed for:

3.6.2.2.1 PWR and BWR Containments

3.6.2.2.1.1 Aging of Inaccessible Concrete Areas

The management of aging in inaccessible areas for increases in porosity and permeability, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel of PWR concrete and steel containments and BWR Mark I concrete containments, Mark II concrete containments, and Mark III concrete and steel containments should be further evaluated. Inspection of PWR and BWR prestressed or concrete containments is currently based on ASME Section XI, Subsection IWL (Ref. 3) examinations in accordance with 10 CFR 50.55a. However, IWL exempts from examination portions of the concrete containments that are inaccessible (e.g., basemat, exterior walls below grades, and concrete covered by liner). To cover the inaccessible areas, 10 CFR 50.55a(b)(2)(ix) requires 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. The GALL report states that IWL and the requirements of 10 CFR 50.55a(b)(2)(ix) are adequate for managing the aging effects, except for inaccessible areas when there are no indications of degradation for accessible areas. The GALL report recommends that an applicant should describe and justify its approach to manage the aging effects for inaccessible areas, when there are no indications of degradation for accessible areas.

3.6.2.2.1.2 Cracking, Distortion, and Increases in Components Stress Level due to Settlement

The management of cracking, distortion, and increases in components stress level due to settlement of PWR concrete and steel containments, BWR Mark II concrete containments and Mark III concrete and steel containments should be further evaluated. The GALL report recommends a settlement monitoring program for a containment in which the basemat is resting on soil or piles, or if the site experiences significant changes in ground water conditions, such as lowering of water tables.

3.6.2.2.1.3 Loss of Strength and Modulus of Concrete Structures due to Elevated Temperature

The management of loss of strength and modulus of elasticity due to elevated temperatures of PWR concrete and steel containments and BWR Mark I concrete containments, Mark II concrete containments, and Mark III concrete and steel containments should be further evaluated. The GALL report recommends that a plant-

specific evaluation should be performed, if any portion of the concrete containment components exceeds specified temperature limits, i.e., general temperature 66^{0}C (150^0 F) and local area temperature 93^{0}C (200^0 F).

3.6.2.2.1.4 Loss of Material due to Corrosion in Inaccessible Areas of Liner Plate and Steel Structures

The management of loss of material due to corrosion of steel structures and liner plate of all types of PWR and BWR containments should be further evaluated. Inspection of steel structures and liner plate of PWR and BWR containments is currently based on ASME Section XI, Subsection IWE (Ref. 4) and IWF (Ref. 5) examinations (IWF for support components of BWR containments, such as downcomer bracing, column and saddle supports, seismic restraints, and vent system supports) in accordance with 10 CFR 50.55a. However, IWE exempts from examination portions of the containments that are inaccessible, such as embedded or inaccessible portions of steel liners and steel containment shells, piping and valves penetrating or attaching to the containment. To cover the inaccessible areas, 10 CFR 50.55a(b)(2)(ix) requires 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. The GALL report states that IWE and the requirements of 10 CFR 50.55a(b)(2)(ix) are adequate for managing the aging effects of corrosion, except for inaccessible areas when there are no indications of degradation for accessible areas. The GALL report recommends that an applicant should describe and justify its approach to manage the aging effects due to corrosion for inaccessible areas, when conditions in accessible areas may not indicate the presence of, or result in, degradation to such inaccessible areas.

3.6.2.2.1.5 Degradation of Protective Coating

The management of loss of material due to degradation of protective coating of all types of PWR and BWR containments should be further evaluated. NRC Generic Letter 98-04 (Ref. 6) indicates that degradation of coatings can lead to clogging of strainers, which in turn can cause loss of intended functions of the post-accident safety-systems, such as containment sump/drain system. The GALL report recommends that a coating monitoring and maintenance program should be implemented for Service Level 1 coating of containment carbon steel components. Draft Regulatory Guide DG-1076 (Ref. 7) recommends ASTM D5163-96 (Ref. 8) as a technical basis for developing a coating monitoring and maintenance program.

3.6.2.2.1.6 Loss of Material of Tendon and Tendon Anchorage Components due to Corrosion

The management of loss of material due to corrosion of prestressing wire or cable for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments should be further evaluated. NUREG-1522 (Ref. 9) and Information Notice 99-10 (Ref. 10) describe that conditions in tendon access galleries are conducive to corrosion of tendon anchorage components. Aging management programs for the prestressed containments should include 10 CFR 50.55a and ASME Section XI, Subsection IWL inservice inspections. The 10 CFR 50.55a and ASME Section XI, Subsection IW L inservice inspections, however, do not apply to bonded post-tensioning systems, such as the tendon access gallery. The GALL report recommends that an

aging managing program should be implemented to manage the conditions and environments in the tendon access gallery, such as moisture and humidity.

3.6.2.2.1.7 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

The management of loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature of PWR prestressed concrete containments and BWR Mark II prestressed concrete containments should be further evaluated. Loss of pretress is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and the evaluation is discussed in detail in Section 4.5 of this standard review plan.

3.6.2.2.1.8 Cumulative Fatigue Damage

The management of fatigue of containment liner plate (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments should be further evaluated. Fatigue of containment liner plate and penetrations is a TLAA to be performed for the period of license renewal, and the evaluation is discussed in detail in Section 4.6 of this standard review plan.

3.6.2.2.1.9 Crack Initiation and Growth due to Stress Corrosion Cracking

The management of crack initiation and growth due to stress corrosion cracking of all types of PWR and BWR containments should be further evaluated. Information Notice 92-20 (Ref. 11) reports an instance of loss of containment leak tightness due to stress corrosion cracking of containment penetration bellows. The GALL report recommends that the containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) should be examined in accordance with examination categories E-F and E-B of 1992 edition of ASME Section XI, Subsection IWE (Ref. 4), if plant-specific operating experience indicates a current or potential problem with leak tightness of containment bellows. In the current term of operation, 10 CFR 50.55a identifies E-F and E-B examinations as optional for the containment penetration components.

3.6.2.2.1.10 Reduction of Foundation Strength due to Erosion of Porous Concrete Subfoundation

The management of reduction of foundation strength due to erosion of porous concrete subfoundations of all types of PWR and BWR containments should be further evaluated. When porous concrete is used in the subfoundation layers below the concrete containment basemat, loss of strength can occur due to erosion of cement from porous concrete subfoundations in the presence of groundwater. The GALL report recommends a subfoundation monitoring and preventive maintenance program for managing this aging effect, if containment rests on porous concrete subfoundation.

3.6.2.2.2 Class I Structures

3.6.2.2.2.1 Aging of Structures Not Covered by Maintenance Rule

The GALL report recommends that the management of aging of structures subject to an aging management review, but not covered by a plant-specific maintenance rule structure monitoring program, should be further evaluated. This relates to the management of scaling, cracking, and spalling due to repeated freeze–thaw; increase in porosity, permeability, scaling, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; expansion and cracking due to reaction with aggregates; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel; cracks, distortion, and increases in components stress level due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundation of Group 1-3, 5-9 Class I structures; loss of material due to corrosion of structural steel components of Groups 1-5, 7-8 Class I structures; crack initiation and growth due to stress corrosion cracking and loss of material due to corrosion of steel liner of Groups 7-8 Class I structures; and loss of material due to corrosion of prestressing tendons anchorage components of Group 4 Class I structure. 10 CFR 50.65 requires each licensee to develop and implement a structure monitoring program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The GALL report states that no further evaluation is required if the structure monitoring program is developed in accordance with the guidance provided in NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Rev.2 (Ref. 12) and that the management of aging effects of the affected Class I structures is within the scope of the program. Otherwise, the aging management program should be evaluated for structure/aging effect combinations not within the scope of the applicant's structure monitoring program.

3.6.2.2.2.2 Aging Management of Inaccessible Areas

For inaccessible areas, such as the basemat and exterior walls below grade, the GALL report recommends that the aging management program should be evaluated on a case-by-case basis to ensure that the intended functions of the affected Class I structures will be maintained during the period of extended operation. This relates to the management of: increases in porosity and permeability, cracking, and spalling due to aggressive chemical attack; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel of Groups 1-3, 5, 7-9 Class I structures; and loss of material due to corrosion of structural steel components of Groups 1-5, 7-8 Class I structures.

3.6.2.2.2.3 Loss of Prestress due to Relaxation, Shrinkage, and Creep

The management of loss of prestress due to relaxation, shrinkage, and creep of Group 4 Class I structure should be further evaluated. Loss of pretress is a TLAA to be performed for the period of license renewal, and the evaluation is discussed in detail in Section 4.5 of this standard review plan.

3.6.2.2.3 Component Supports

3.6.2.2.3.1 Aging of Supports Not Covered by Maintenance Rule

The GALL report recommends that the management of aging of supports subject to an aging management review, but not covered by a plant-specific maintenance rule structure monitoring program, should be further evaluated. This relates to the management of: loss of material due to environmental corrosion of Groups B2, B3, B4, and B5 component supports; reduction in concrete capacity due to vibration loads or other effects on concrete surrounding anchor bolts, and grout pads of all groups of component supports; loosening and slipping of bolted friction connections due to thermal cycling/vibration of Group 2 component support; reduction/loss of isolation function due to sustained vibration loading of vibration isolation elements of Group 4 component support. 10 CFR 50.65 requires each licensee to develop and implement a structure monitoring program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components (including component supports). The GALL report states that no further evaluation is required if the structure monitoring program is developed in accordance with the guidance provided in NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Rev.2 (Ref. 12) and the management of the aging effects of the affected component supports is within the scope of the program. Otherwise, the aging management program should be evaluated for component support/aging effect combinations not within the scope of the applicant's structure monitoring program.

3.6.2.2.3.2 Loss of Material due to Boric Acid Corrosion

The management of loss of material due to boric acid corrosion of all groups of component supports should be further evaluated. The GALL report states that no further evaluation is required if the boric acid monitoring program is implemented in accordance with NRC Generic Letter 88-05 (Ref. 13) and the program contains visual inspection of adjacent structures, components, and supports for evidence of leakage and corrosion. Otherwise, the plant-specific aging management program should be evaluated.

3.6.2.2.3.3 Cumulative Fatigue Damage due to Cyclic Loading

The management of fatigue of containment support members, anchor bolts, and welds of Groups B1.1, B1.2, B2, and B4 component support should be further evaluated. Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal, and its treatment is discussed in detail in Section 4.3 of this standard review plan.

3.6.2.2.4 Quality Assurance for Aging Management of Non-Safety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1, Appendix A.2 of this standard review plan.

3.6.2.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.2.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.2.5 FSAR Supplement

The summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should provide appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the integrated plant assessment regarding the bases for determining that aging effects are managed in the period of extended operation.

3.6.3 Review Procedures

For each area of review, the following review procedures are to be followed:

3.6.3.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in its license renewal application, as appropriate. The staff should not repeat its review of the matters described in the GALL report. The staff should find it acceptable when the GALL report is referenced in a license renewal application, if the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. The reviewer verifies that the applicant has provided a brief description of the structures, components, materials, and environment, and has stated that the particular plant is bounded by the GALL report. The reviewer also verifies that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience had been reviewed by the applicant and are bounded by the GALL report. The reviewer verifies that the applicant has identified those aging effects for the structures and structural components that are contained in the GALL report as applicable to its plant. The reviewer reviews any outliers identified by the applicant.

The applicant may state that certain aging management programs and the staff evaluation, as described in the GALL report, are applicable to its plant. The reviewer verifies that the applicant has identified the appropriate programs as described and evaluated in the GALL report. Programs evaluated in the GALL report regarding the structures and structural components are tabulated in Table 3.6-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

3.6.3.2 Further Evaluation of Aging Management as Recommended by the GALL Report

3.6.3.2.1 PWR and BWR Containments

3.6.3.2.1.1 Aging of Inaccessible Concrete Areas

The reviewer reviews the applicant's aging management program to manage aging in inaccessible areas for increases in porosity and permeability, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel of PWR concrete and steel containments and BWR Mark I concrete containments, Mark II concrete containments, and Mark III concrete and steel containments. The reviewer verifies that the applicant has identified the inaccessible areas such as the basemat and exterior walls below grade. The aging management program is plant-specific and should be evaluated on an individual plant basis in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan. The reviewer reviews the applicant's proposed programs to verify that an effective plant-specific aging management program has been developed.

3.6.3.2.1.2 Cracking, Distortion, and Increases in Component Stress Level due to Settlement

The reviewer reviews the applicant's structure settlement monitoring program to manage settlement of PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. The reviewer verifies that the applicant has a structure settlement monitoring program, if the containment/basemat is resting on soil or piles, or if the site experiences significant changes in ground water conditions, such as lowering of water tables. A settlement monitoring program measuring the differences on elevations of structures would ensure that the differential settlement does not exceed the design criteria for the containment structures during the period of extended operation.

3.6.3.2.1.3 Loss of Strength and Modulus of Concrete Structures due to Elevated Temperature

The reviewer verifies that the applicant's discussion in the renewal application indicates that the affected PWR and BWR containment components are not exposed to temperature that exceeds the temperature limits [operating temperature <66^{0}C (150^{0}F), and local area temperature <93^{0}C (200^{0}F)].

For containment concrete components that operate above the temperature limits [operating temperature <66^{0}C (150^{0}F), local area temperature <93^{0}C (200^{0}F)], they are reviewed on a case-by-case basis to ensure that the effects of elevated temperature will be managed to maintain their intended function during the period of extended operation.

3.6.3.2.1.4 Loss of Material Due to Corrosion in Inaccessible Areas of Liner Plate and Steel Structures

The reviewer reviews the applicant's aging management program to manage the loss of material due to corrosion in inaccessible areas of liner plate and steel structures

of all types of PWR and BWR containments. The reviewer verifies that the applicant has identified the inaccessible areas of liner plate and steel structures. The aging management program is plant-specific and should be evaluated on an individual plant basis in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan. The reviewer reviews the applicant's proposed programs to verify that an effective plant specific aging management program has been developed.

3.6.3.2.1.5 Degradation of Protective Coating

The reviewer reviews the applicant's aging management program to manage loss of material due to degradation of protective coating of the carbon steel components of all types of PWR and BWR containment. Early detection and timely correction of coating degradation are key elements of an acceptable protective coating monitoring and maintenance program. The reviewer verifies that visual inspection of the conditions of the coating is conducted at the beginning of each refueling outage as recommended in the GALL report. The reviewer verifies that the technical basis of the program is consistent with the guidelines provided in ASTM D5163-96. The reviewer reviews the applicant's proposed programs to verify that an effective plant-specific aging management program has been developed.

3.6.3.2.1.6 Loss of Material of Tendons and Tendon Anchorage Components due to Corrosion

The reviewer reviews the applicant's aging management program to manage the loss of material due to corrosion for tendons and tendon anchorage components of PWR prestressed concrete containments and BWR Mark II prestressed concrete containments. The reviewer verifies that an aging managing program is implemented to manage the conditions of moisture and humidity in the tendon access gallery as recommended in the GALL report. The aging management program is plant-specific and should be evaluated in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.3.2.1.7 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Loss of pretress is a TLAA to be performed for the period of license renewal. The staff should review the evaluation of this TLAA separately, following the guidance in Section 4.5 of this standard review plan.

3.6.3.2.1.8 Cumulative Fatigue Damage

Fatigue of the containment liner plate and penetrations is a TLAA to be performed for the period of license renewal. The staff should review the evaluation of this TLAA separately, following the guidance in Section 4.6 of this standard review plan.

3.6.3.2.1.9 Crack Initiation and Growth due to Stress Corrosion Cracking

The reviewer reviews the applicant's augmented program to manage crack initiation and growth due to stress corrosion cracking of all types of PWR and BWR containments. The GALL report indicates that 10 CFR 50.55a identifies examination categories E-B and E-F

of IWE as optional during the current term of operation. The reviewer reviews the applicant's plant-specific operating experience with cracking of containment bellows. If plant-specific operating experience indicates a current or potential problem with leak tightness of containment bellows, the reviewer verifies that the containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) are examined in accordance with the requirements of examination categories E-F and E-B of 1992 edition of ASME Section XI, Subsection IWE.

3.6.3.2.1.10 Reduction of Foundation Strength due to Erosion of Porous Concrete Subfoundation

The reviewer reviews the applicant's subfoundation monitoring program to manage reduction of foundation strength due to porous concrete corrosion of all types of PWR and BWR containments. The reviewer verifies that a subfoundation monitoring and preventive maintenance program is implemented, if containment structures rest on a porous concrete subfoundation. The reviewer verifies that this program has provided an effective way to detect the evidence of structural settlement. Information Notice 98-26 (Ref. 14) provides detailed discussion on selection of inspection locations, such as at discontinuities and large penetrations of concrete structures. The aging management program is plant-specific and should be evaluated in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.3.2.2 Class I Structures

3.6.3.2.2.1 Aging of Structures Not Covered by Maintenance Rule

The reviewer reviews the applicant's aging management program to manage scaling, cracking, and spalling due to repeated freeze–thaw; increase in porosity, permeability, scaling, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; expansion and cracking due to reaction with aggregates; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel; cracks, distortion, and increases in components stress level due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundation of Group 1-3, 5-9 Class I structures; loss of material due to corrosion of structural steel components of Groups 1-5, 7-8 Class I structures; crack initiation and growth due to stress corrosion cracking and loss of material due to corrosion of steel liner of Groups 7-8 Class I structures; and loss of material due to corrosion of prestressing tendons anchorage components of Group 4 Class I structure. The reviewer verifies that the applicant has identified the structure/aging effect combinations not within the scope of the applicant's structure monitoring program developed in accordance with the guidance provided in NUMARC 93-01, Revision 2 and Regulatory Guide 1.160, Rev.2. The applicant may choose to expand the scope of its structure monitoring program to include these structure/aging effect combinations. Otherwise, for a plant-specific program, the reviewer evaluates the plant-specific program in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.3.2.2.2 Aging Management of Inaccessible Areas

For inaccessible areas, such as foundation and exterior walls below grade exposed to ground water, the reviewer evaluates the aging management program on a case-by-case basis for the management of increases in porosity and permeability, cracking, and spalling due to aggressive chemical attack; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel of Groups 1-3, 5, 7-9 Class I structures; and loss of material due to corrosion of structural steel components of Groups 1-5, 7-8 Class I structures to assure that the intended functions will be maintained consistent with the CLB during the period of the extended operation.

3.6.3.2.2.3 Loss of Prestress due to Relaxation, Shrinkage, and Creep

The reviewer reviews the applicant's aging management program to manage loss of prestress due to relaxation, shrinkage, and creep of Group 4 Class I structure. Loss of prestress is a TLAA. The staff should review the evaluation of this TLAA separately following the guidance in Section 4.5, "Concrete Containment Tendon Prestress" of this standard review plan.

3.6.3.2.3 Component Supports

3.6.3.2.3.1 Aging of Supports Not Covered by Maintenance Rule

The reviewer reviews the applicant's aging management program for the management of: loss of material due to environmental corrosion of Groups B2, B3, B4, and B5 component supports; reduction in concrete capacity due to vibration loads or other effects on concrete surrounding anchor bolts, and grout pads of all groups of component supports; loosening and slipping of bolted friction connections due to thermal cycling/vibration of Group 2 component support; reduction/loss of isolation function due to sustained vibration loading of vibration isolation elements of Group 4 component support. The reviewer verifies that the applicant has identified the component support/ aging effect combinations not within the scope of the applicant's structure monitoring program developed in accordance with the guidance provided in NUMARC 93-01, Rev. 2 and Regulatory Guide 1.160, Rev. 2. The applicant may choose to expand the scope of its structure monitoring program to include these structure/aging effect combinations. Otherwise, for a plant-specific program, the reviewer evaluates the plant-specific program in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.3.2.3.2 Loss of Material due to Boric Acid Corrosion

The reviewer reviews the applicant's aging management program to manage loss of material due to boric acid corrosion of support members, anchor bolts, and welds of all groups of component supports. The reviewer verifies that visual inspection of adjacent structures, components, and supports for evidence of leakage and corrosion is contained in the applicant's Generic Letter 88-05 boric acid monitoring program. Otherwise, plant-specific evaluation should be performed.

3.6.3.2.3.3 Cumulative Fatigue Damage due to Cyclic Loading

The reviewer reviews the applicant's aging management program to manage fatigue of support members, anchor bolts, and welds of Groups B1.1, B1.2, B2, and B4 component supports. Fatigue is a TLAA to be performed for the period of license renewal. The staff should review the evaluation of this TLAA separately, following the guidance in Section 4.3 of this standard review plan.

3.6.3.2.4 Quality Assurance for Aging Management of Non-Safety-Related Components

An applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, for non-safety-related components that are subject to an aging management review for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address the associated program elements. If an applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If an applicant chooses other alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.6.3.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.3.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.6.3.5 FSAR Supplement

The reviewer verifies that the applicant's FSAR supplement for aging management of the structures and structural components for license renewal is consistent with Table 3.6-2 of this review plan section. The reviewer also verifies that the applicant has provided an FSAR supplement for Subsection 3.6.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.6.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section using a format similar to that in Table 3.6-2.

3.6.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

The staff evaluation concludes that the applicant has demonstrated that the aging effects associated with the structures and structural components will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the current licensing basis during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the structures and structural components.

3.6.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

3.6.6 References

1. NUREG-0800, "Standard review plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 1981.

2. NUREG-xxxx, "Generic Aging Lessons Learned (GALL) Report," U.S. Nuclear Regulatory Commission, XXXX.

3. 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.

4. 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.

5. 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.

6. 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.

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

8. 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."

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

10. NRC Information Notice 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," April 13, 1999.

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

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

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

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

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

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

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

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

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

Table 3.6-1. Aging Management Programs for Structures and Structural Components Evaluated in Chapters II and III of the GALL Report

Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
Common Components of All Types of PWR and BWR Containment			
Penetration sleeves, penetration bellows, and dissimilar metal welds	Loss of material from corrosion	ASME IWE inservice inspection in accordance with 10 CFR 50.55a and Appendix J containment leak rate tests.	Yes, for inaccessible areas (see Subsection 3.6.2.2.1.4).
Penetration sleeves, penetration bellows, and dissimilar metal welds	Cumulative fatigue damage from cyclic loading	TLAA	Yes, TLAA (see Section 4.6 of this standard review plan).
Penetration sleeves, penetration bellows, and dissimilar metal welds	Crack initiation and growth from stress corrosion cracking	ASME IWE inservice inspection	No, except for bellows. Plant-specific operating experience with cracking of containment bellows should be evaluated (see Subsection 3.6.2.2.1.9).
Subfoundation layer	Reduction in foundation strength from erosion of porous concrete subfoundation	Plant-specific monitoring and preventive program of subfoundation settlement	Yes, for containment structures that have a porous concrete subfoundation, plant-specific evaluation is required (see Subsection 3.6.2.2.1.10)
Personnel airlock and equipment hatch	Loss of material from corrosion; Fretting/lock-up from wear of locks, hinges, and closures mechanisms	ASME IWE inservice inspection in accordance with 10 CFR 50.55a and Appendix J containment leak rate tests.	No
Seals and gaskets	Loss of seal- ant and leak- age through containment from deterioration of joint	ASME IWE inservice inspection in accordance with 10 CFR 50.55a and Appendix J	No

	sealants and gaskets	containment leak rate tests	
PWR Containment Concrete (Reinforced and Prestressed) and Steel **BWR Containment (Mark I, II and III) Concrete and Steel**			
Inaccessible concrete areas such as basemat, exterior walls below grade	Aging of inaccessible concrete areas: Increase in porosity, permeability, scaling, cracking, and spalling from leaching of calcium hydroxide and from aggressive chemical attack; Cracking, spalling, loss of bond, and loss of material from corrosion of embedded steel	ASME IWL inservice Inspection in accordance with 10 CFR 50.55a	Yes, for inaccessible areas (see Subsection 3.6.2.2.1.1).
Containment structure and basemat	Cracks, distortion, and increases in components stress level from settlement	Plant-specific structure settlement monitoring program	Yes, for a containment resting on soil or piles, or for sites which experience significant changes in ground water conditions (see Subsection 3.6.2.2.1.2).
PWR: Dome, wall, basemat, ring girder, and buttresses BWR: Drywell, torus dome, wall, basemat, concrete fill in annulus	Loss of strength and modulus from elevated temperature	No mandated aging management program exists	Yes, for any portions of concrete containment that exceed specified temperature limits (see Subsection 3.6.2.2.1.3).
PWR: Liners, liner anchors, and structural steel. containment shell, etc. BWR: Drywell, suppression	Loss of material from corrosion in inaccessible areas of liner plates & steel structures	ASME IWE inservice inspection in accordance with 10 CFR 50.55a and Appendix J containment leak rate tests	Yes, for inaccessible areas (see Subsection 3.6.2.2.1.4).

chamber liners, downcomer bracing, saddle support, etc.			
PWR; Concrete: Liners, liner anchors, and structural steel. BWR: Drywell, suppression chamber liners, downcomer bracing, saddle support, etc.	Degradation of protective coating	Plant-specific coating monitoring and maintenance program	Yes, plant-specific coating monitoring and maintenance program (see Subsection 3.6.2.2.1.5).
PWR & BWR Mark II prestressed containment: Tendons and anchorage components	Loss of material from corrosion of prestressing tendons anchorage components	ASME IWL inservice inspection in accordance with 10 CFR 50.55a	Yes, plant specific conditions of tendon gallery (see Subsection 3.6.2.2.1.6).
PWR & BWR Mark II prestressed containment: Tendons and anchorage components	Loss of prestress from relaxation, shrinkage, creep, and elevated temperature	ASME IWL inservice inspection in accordance with 10 CFR 50.55a and Regulatory Guide 1.35.1 (Ref. 15)	Yes, TLAA (see Section 4.5 of this standard review plan).
PWR: Dome, wall, basemat, etc. BWR: Drywell, torus, Basemat, etc.	Scaling, cracking, and spalling from freeze-thaw; expansion and cracking from reaction with aggregate	ASME IWL inservice Inspection in accordance with 10 CFR 50.55a	No
BWR: Concrete and steel Mark I: Vent line bellows.	Cumulative fatigue damage from cyclic loading	TLAA	Yes, TLAA (see Section 4.6 of this standard review plan).
BWR: Concrete and steel Mark I: Vent line bellows.	Crack initiation and growth from stress corrosion cracking	ASME IWE inservice inspection in accordance with 10 CFR 50.55a	Yes, plant-specific operating experience with cracking of containment bellows (see Subsection 3.6.2.2.1.9).

BWR: Suppression chamber liner (interior surface)	Crack initiation and growth from stress corrosion cracking	ASME IWE inservice inspection in accordance with 10 CFR 50.55a and Appendix J containment leak rate tests	No
BWR: Drywell head, downcomers, and bracing system.	Fretting and lock up from wear of locks, hinges and closures mechanisms	ASME IWE inservice inspection in accordance with 10 CFR 50.55a	No
Class I Structures			
All Groups except Group 6 : Accessible interior/exterior concrete & steel components: such as exterior concrete above grade, structural steel components, steel liner of concrete and steel tanks	Aging of structures not covered by Maintenance Rule: Scaling, cracking, and spalling from freeze-thaw; increase in porosity, permeability, scaling, cracking & spalling from leaching of calcium hydroxide and aggressive chemical attack; expansion and cracking from reac-tion with aggregate; cracking, spalling, loss of bond, and loss of material from corrosion of embedded steel; loss of material from corrosion; cracks, distortion, and increases in components stress level from settlement; reduction in foundation strength from erosion of porous concrete sub-foundation; crack initiation & growth from SCC and loss of material from crevice corrosion; loss of material from	Maintenance Rule (MR) structure monitoring program in accordance with 10CFR50.65 or plant-specific structure monitoring program	No, if within the scope of the applicant's MR structure monitoring program. Otherwise, the aging management program should be evaluated for structure/aging effect combinations not within the scope of the applicant's structure monitoring program. (see Subsection 3.6.2.2.2.1).

	corrosion of prestressing tendons anchorage components		
All Groups except Group 6: Inaccessible concrete & steel components such as exterior walls below grade and foundation	Aging Management of inaccessible Areas: Increase in porosity, permeability, scaling, cracking, and spalling from aggressive chemical attack; cracking, spalling, loss of bond, and loss of material from corrosion of embedded steel; loss of material from corrosion	Plant-specific aging management program	Yes, evaluation should be performed on a case-by-case basis (see Subsection 3.6.2.2.2.2).
Group 4: Tendons of prestressed system	Loss of prestress from relaxation, shrinkage, and creep.	TLAA	Yes, TLAA (see Section 4.5 of this standard review plan).
Group 6: All accessible/ inaccessible concrete & steel components	All types of aging effects including loss of material from abrasion and cavitation	Regulatory. Guide 1.127 (Ref. 16)	No
Group 5: Liners	Crack initiation and growth from stress corrosion cracking and loss of material from crevice corrosion	Periodic monitoring of the leak chase system drain lines and the leak detection sump	No
Groups 1-3, 5-6: All masonry block walls	Cracking from restraint, shrinkage, creep, and aggressive environment	Implementation of IE Bulletin 80-11 (Ref. 17) and Information Notice 87-67 (Ref. 18) for inspection and monitoring all masonry block walls	No
Component Supports:			
All Groups:: Support members, anchor bolts,	Aging of component supports not covered by Maintenance Rule: Loss of material from	Maintenance Rule (MR) structure monitoring program	No, if within the scope of the applicant's MR structure monitoring program. Otherwise,

and welds, concrete surrounding anchor bolts, grout pad, bolted friction connections etc.	environmental corrosion; reduction/ loss of isolation function from sustained vibration loading		the aging management program should be evaluated for component support/aging effect combinations not within the scope of the applicant's structure monitoring program. (see Subsection 3.6.2.2.3.1).
All Groups: Support members, anchor bolts, and welds	Loss of material from boric acid corrosion	Implementation of Generic Letter 88-05	No, provided that visual inspection of adjacent areas is included in the applicant's boric acid aging management program of reactor coolant pressure boundary. Otherwise plant-specific evaluation is required (see Subsection 3.6.2.2.3.2).
Groups B1.1, B1.2, B2, and B4: Support members, anchor bolts & welds	Cumulative fatigue damage from cyclic loading	TLAA	Yes, TLAA (see Section 4.6 of this standard review plan).
Groups B1.1, B1.2, B2, and B4: Support members, anchor bolts, welds, spring hangers, guides, stops, and vibration isolators	Loss of material from environmental corrosion; loss of mechanical function from corrosion, distortion, dirt, overload; crack initiation and growth from stress corrosion cracking	ASME IWF inservice inspection in accordance with 10 CFR 50.55a	No
Group B1.1: High strength low-alloy bolts	Crack initiation and growth from stress corrosion cracking	Implementation of Generic Letter 91-17 (Ref. 19)	No

Table 3.6-2. FSAR Supplement for Aging Management of Structures and Structural Components

Program	Description of Program	Implementation Schedule
PWR and BWR Containments		
Containment inservice inspection	The ASME Section XI, Subsection IWL program consists of periodic visual inspection of external surfaces of concrete and unbonded post-tensioning systems for signs of degradation and assessment of the damage and corrective actions. The ASME Section XI, Subsection IWE program consists of periodic visual, surface, and volumetric inspection for pressure retaining components. Tendons are also managed in accordance with Regulatory Guide 1.35.1. This program is implemented in accordance with 10 CFR 50.55a.	Existing program
Containment leak rate test (LRT) program	This program consists of monitoring of leakage rates through containment liner/welds, penetrations, fittings, and other access openings for detecting degradation of containment pressure boundary. Corrective actions are taken if leakage rates exceed acceptance criteria. This program is implemented in accordance with 10 CFR 50, Appendix J and Regulatory Guide 1.163.	Existing program
Coating monitoring and maintenance program	This program consists of periodic visual inspection of the conditions of Service Level I coatings to prevent coating degradation which may lead to clogging of the containment sump/drain system.	Existing program
Stress corrosion cracking inspection program of containment penetration components	To mitigate the aging effects on containment penetration components exposed to corrosive environment, examination categories of E-F and E-B of ASME Section XI, Subsection IWL are used to detect stress corrosion cracking of penetration sleeves, penetration bellows, and dissimilar welds.	Program will be implemented by .....
Containment structure	A settlement monitoring program consists of measuring the differences in elevations of structures to ensure that the differential	Existing program

settlement monitoring program	settlement does not exceed the design criteria for the containment structures during the period of extended operation.	
Subfoundation settlement monitoring and preventive maintenance program	The subfoundation monitoring and preventive maintenance programs consist of inspection and monitoring of containment structures (that have porous concrete subfoundations) and the associated systems and components for evidence of structural settlement and assessment of the degraded conditions and corrective actions. The program is within the scope of structure monitoring and maintenance in accordance with the maintenance rule (10 CFR 50.65).	Program will be implemented by .....
	Class I Structures	
Maintenance Rule (MR) structure monitoring program	The program consists of periodic inspection for detecting the aging effects and includes the inspection schedule, inspection methods, inspector quality, and corrective actions. This program is implemented in accordance with 10 CFR 50.65.	Existing program
Implementation of Regulatory Guide 1.127 for water-control structures	The program consists of inspection at periodic intervals not to exceed 5 years, engineering data compilation, inspection, and evaluation of concrete and steel surfaces, structural cracking, settlement and water passage.	Existing program
Periodic monitoring of the leak chase system drain lines and the leak detection sump of fuel storage facility and refuel channel	This program consists of periodic monitoring of the leak chase system drain lines and the leak detection sump of fuel storage facility and refueling channel for managing the aging effects of stress corrosion cracking and crevice cracks of liners.	Existing program
Implementation of IE Bulletin 80-11 and Information Notice 87-67 for inspection and monitoring all masonry block walls	This program consists of inspection requirements in accordance ~~to~~ with IE Bulletin 80-11 and plant-specific monitoring requirements proposed by Information Notice 87-67 for managing the aging effects due to cracking of masonry walls.	Existing program

Component Supports		
Component support inservice inspection	The ASME Section XI, Subsection IWF program consists of periodic visual inspection of supports of Class 1, 2, and 3 piping and components for signs of degradation, and acceptance criteria and corrective actions for managing the aging effects due to environmental corrosion, stress corrosion cracking, distortion, dirt, overload, and elastomer hardening. The program is implemented in accordance with 10 CFR 50.55a.	Existing program
Maintenance Rule (MR) structure monitoring program	The program consists of periodic inspection for detecting of the aging effects and includes the inspection schedule, inspection methods, inspector quality, and corrective actions for management the aging effects of reduction in concrete capacity due to vibration load, etc. This program is implemented in accordance with 10 CFR 50.65.	Existing program
Boric acid corrosion inspection program	This program consists of monitoring and visual inspection of the component supports adjacent to the reactor coolant pressure boundary for evidence of borated water leakage. Corrective actions are taken to prevent recurrence. This program is implemented in accordance with NRC Generic Letter 88-05.	Existing program
Management of stress corrosion cracking of high strength low-alloy bolts in accordance with NRC Generic Letter 91-27	This program is implemented in accordance with NRC Generic Letter 91-27 for ensuring bolting reliability.	Existing program
Quality assurance	The 10 CFR Part 50, Appendix B program provides for corrective actions, confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include non-safety-related structures and components that are subject to an aging management review for license renewal.	Program will be implemented by .....

3.7 AGING MANAGEMENT OF ELECTRICAL AND INSTRUMENTATION AND CONTROLS

Review Responsibilities

Primary - Branch responsible for electrical engineering
Secondary - None

3.7.1 Areas of Review

This review plan section addresses the aging management review of the Electrical and Instrumentation and Controls (I&C) for license renewal. For a recent vintage plant, the information related to the Electrical and Instrumentation and Controls is contained in Chapter 7, "Instrumentation and Controls," and Chapter 8, "Electric Power," of the plant's Final Safety Analysis Report (FSAR) consistent with the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) (Ref. 1). Typical electrical and I&C components consist of the following: electrical penetrations, electrical cables and connections, motors, diesel generators, pressure indicators, switchgear, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies.

The staff has issued a Generic Aging Lessons Learned (GALL) report addressing aging management for license renewal (Ref. 2). The GALL report documents generically the staff's basis for determining when existing programs are adequate to manage aging without change and when existing programs should be augmented for license renewal. The GALL report may be referenced in a license renewal application and should be treated in the same manner as an approved topical report.

Because a license renewal applicant may or may not be able to reference the GALL report, the following areas are reviewed:

3.7.1.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

The staff should not repeat its review of the matters described in the GALL report and should find it acceptable when the GALL report is referenced in a license renewal application. However, the staff should ensure that the material presented in the GALL report is applicable to the specific plant involved. The staff should also verify that the applicant has identified specific programs as described and evaluated in the GALL report.

3.7.1.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report provides the basis for identifying those programs that warrant further evaluation during the staff review of a license renewal application. The staff review should focus on augmented programs for license renewal.

3.7.1.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

The GALL report provides a generic staff evaluation of certain aging management programs. If an applicant does not rely on a particular program for license renewal, or if the applicant

indicates that the generic staff evaluation of the elements of a particular program does not apply to its plant, the staff should review the applicant's aging management programs.

3.7.1.4 Components or Aging Effects that Are Not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of certain components and aging effects. If an applicant has identified particular components subject to aging management review for its plant, or if the applicant has identified particular aging effects for a component, that are not addressed in the GALL report, the staff should review the applicant's aging management programs.

3.7.1.5 FSAR Supplement

The FSAR supplement summarizing the programs and activities for managing the effects of aging for the period of extended operation is reviewed.

3.7.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21.

3.7.2.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

Acceptable methods for managing aging of the electrical and instrumentation and controls (I&C) components are described and evaluated in Chapter VI of the GALL report (Ref. 2). In referencing the GALL report, an applicant should indicate that the material presented in the GALL report is applicable to the specific plant involved and provide the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. An applicant may reference appropriate programs as described and evaluated in the GALL report.

3.7.2.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report indicates that further evaluation should be performed for:

3.7.2.2.1 Electrical Equipment Subject to Environmental Qualification (EQ)

EQ is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is addressed separately in Section 4.4 of this standard review plan.

3.7.2.2.2 Non-EQ Electrical Cables, Connectors, and Penetrations

There are plant-specific programs to manage aging of non-EQ electrical cables, connectors, and penetrations. Aging inspection and instrument calibration programs are acceptable programs.

3.7.2.2.3 Quality Assurance for Aging Management of Non-Safety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1, Appendix A.2 of this standard review plan.

3.7.2.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.7.2.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.7.2.5 FSAR Supplement

The summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should provide appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the integrated plant assessment regarding the bases for determining that aging effects are managed in the period of extended operation.

3.7.3 Review Procedures

For each area of review, the following review procedures are to be followed:

3.7.3.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in its license renewal application, as appropriate. The staff should not repeat its review of the matters described in the GALL report. The staff should find it acceptable when the GALL report is referenced in a license renewal application, if the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. The reviewer verifies that the applicant has provided a brief description of the system, components, materials, and environment, and has stated that the particular plant is bounded by the GALL report. The reviewer also verifies that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience had been reviewed by the applicant and are bounded by the GALL report. The reviewer verifies that the applicant has identified those aging effects for the Electrical and I&C System Components that are contained in the GALL report as applicable to its plant. The reviewer reviews any outliers identified by the applicant.

The applicant may state that certain aging management programs and the staff evaluation, as described in the GALL report, are applicable to its plant. The reviewer verifies that the applicant has identified the appropriate programs as described and evaluated in the GALL report. Programs evaluated in the GALL report regarding the Electrical and I&C System Components are tabulated in Table 3.7-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

3.7.3.2 Further Evaluation of Aging Management as Recommended by the GALL Report

3.7.3.2.1 Electrical Equipment Subject to Environmental Qualification (EQ)

EQ is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff reviews the evaluation of this TLAA separately following the guidance in Section 4.4 of this standard review plan.

3. 7.3.2.2 Non-EQ Electrical Cables, Connectors, and Penetrations

Aging management programs for non-EQ electrical cables, connectors, and penetrations are plant specific. If an applicant chooses to aging inspection and instrument calibration programs to manage aging of these components, the reviewer verifies that the aging inspection program consists of visual inspection of indication of aging degradation. The visual inspection should check for surface anomalies, such as discoloration, cracking or surface contamination that would indicate the presence of active aging degradation. For cables, if the jacket or insulation can be touched, a qualitative indication of material hardening should be made. Observation of aging degradation should indicate the need for further investigation of the component. The reviewer also verifies that the instrument calibration program, including technical specification surveillance, should provide an indirect indication of the condition of various electrical components. If calibration drift is noted for the instrument, this should be an indication that aging degradation is affecting the electrical circuit. Further investigation should then be initiated to determine the nature of the degradation and the component affected.

3.7.3.2.3 Quality Assurance for Aging Management of Non-Safety-Related Components

An applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, for non-safety-related components that are subject to an aging management review for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B, program to include these components to address these program elements. If an applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If an applicant chooses other alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.7.3.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.7.3.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.7.3.5 FSAR Supplement

The reviewer verifies that the applicant's FSAR supplement for aging management of the Electrical and I&C System for license renewal is consistent with Table 3.7-2 of this review plan section. The reviewer also verifies that the applicant has provided FSAR supplement for Subsection 3.7.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.7.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section using a format similar to that in Table 3.7-2.

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has demonstrated that the aging effects associated with the Electrical and I&C System will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the current licensing basis during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the Electrical and I&C System.

3.7.4 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

3.7.5 References

1. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 1981.

2. NUREG-xxxx, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, XXXX.

Table 3.7-1. Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL Report

Component	Aging Effect/ Mechanisms	Aging Management Programs	Further Evaluation Recommended
Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	EQ program	Yes, if TLAA is to be projected to the end of the period of extended operation by re-analysis, the re-analysis should be evaluated (see Subsection 3.7.2.2.1).
Non-EQ electrical cables, connectors, and penetrations	Degradation due to various aging mechanisms	Aging inspection and instrument calibration	Yes (see subsection 3.7.3.2.2).
Electrical buses, insulators, transmission conductors, and ground conductors	Degradation due to various aging mechanisms	Electrical bus, insulator, transmission conductor, and ground conductor inspection program	No

Table 3.7-2. FSAR Supplement for Aging Management of Electrical and Instrumentation and Controls System

Program	Description of Program	Implementation Schedule
Aging inspection and instrument calibration programs	To manage the aging of electrical components that are not subject to the environmental qualification (EQ) requirements in 10 CFR 50.49, the aging inspection program consists of visual inspection to check for surface anomalies, such as discoloration, cracking or surface contamination that would indicate the presence of active aging degradation; the instrument calibration programs, including technical specification surveillance, provides an indirect indication of the condition of various electrical components.	Existing programs
Electrical bus, insulators, transmission conductors, and ground conductors inspection program	To manage aging of electrical buses, insulators, transmission conductors, and ground conductors, periodic visual inspection is performed to check for indications of aging degradation, including infrared thermography to identify hot spots.	Existing programs
Quality assurance	The 10 CFR Part 50, Appendix B, program provides for corrective actions, confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include non-safety-related structures and components that are subject to an aging management review for license renewal.	Program will be implemented by .....

4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

Review Responsibilities

Primary - Branch responsible for materials and chemical engineering
Secondary - Other branches responsible for engineering, as appropriate

4.1.1 Areas of Review

This review plan section addresses the identification of time-limited aging analyses (TLAAs). There are certain plant-specific safety analyses which may have been based on an explicitly assumed 40-year plant life (for example, aspects of the reactor vessel design). Pursuant to 10 CFR 54.21(c)(1), a license renewal applicant is required to provide a list of TLAAs, as defined in 10 CFR 54.3. The area relating to the identification of TLAAs is reviewed.

TLAA requirements may have evolved and are plant-specific. As indicated in 10 CFR 54.30, the adequacy of the plant's current licensing basis (CLB), which includes TLAAs, is not an area of review. Potential concerns or enhancements regarding the CLB is to be addressed under the backfit rule (10 CFR 50.109) and are separate from the license renewal process.

In addition, pursuant to 10 CFR 54.21(c)(2), an applicant must provide a list of plant-specific exemptions that are based on TLAAs. However, the initial license renewal applicants have found no such exemptions for their plants.

An applicant has the flexibility to determine the set of analyses for which an evaluation is performed, provided that this set encompasses the TLAAs for which the Commission has determined an evaluation is required. Therefore, the reviewer should not review all analyses that the applicant has identified as TLAAs, because it is an applicant's option to include more analyses than those required by 10 CFR 54.21(c)(1). The staff should focus its review to confirm that the applicant did not omit any TLAAs, as defined in 10 CFR 54.3.

4.1.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Subsection 4.1.1 of this review plan section define acceptable methods for meeting the requirements of the Commission's regulations in 10 CFR 54-21(c)(1). The staff should find no omission of TLAAs, as defined in 10 CFR 54.3, from the applicant's list.

Pursuant to 10 CFR 54.3, TLAAs are those licensee calculations and analyses that:

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a);

2. Consider the effects of aging;

3. Involve time-limited assumptions defined by the current operating term, for example, 40 years;

4. Were determined to be relevant by the licensee in making a safety determination;

5. Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in 10 CFR 54.4(b); and

6. Are contained or incorporated by reference in the CLB.

4.1.3 Review Procedures

For each area of review described in Subsection 4.1.1 of this review plan section, the following review procedures are followed:

The reviewer verifies that the TLAAs identified by the applicant meet the following criteria (Ref. 1).

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a). Chapter 2 of this standard review plan provides staff review guidance on the scoping and screening methodology, plant level and various system level scoping results.

2. Consider the effects of aging. The effects of aging include, but are not limited to: loss of material, loss of toughness, loss of prestress, settlement, cracking, and loss of dielectric properties.

3. Involve time-limited assumptions defined by the current operating term, for example, 40 years. The defined operating term should be explicit in the analysis. Simply asserting that a component is designed for a service life or plant life is not sufficient. The assertion should be supported by a calculation or analysis that explicitly includes a time limit.

4. Were determined to be relevant by the licensee in making a safety determination. Relevancy is a determination that the applicant should make based on a review of the information available. A calculation or analysis is relevant if it can be shown to have direct bearing on the action taken as a result of the analysis performed. Analyses are also relevant if they provide the basis for a licensee's safety determination and, in the absence of the analyses, the licensee may have reached a different safety conclusion.

5. Show capability of the system, structure, and component to perform its intended functions, as delineated. Involve conclusions or provide the basis for conclusions related to the 10 CFR 54.4(b). Analyses that do not affect the intended functions of systems, structures, and components are not TLAAs.

6. Are contained or incorporated by reference in the CLB. Plant specific documents contained or incorporated by reference in the CLB include, but are not limited to: FSAR, NRC safety evaluation reports (SERs), Technical Specifications, the fire protection plan/hazards analyses, correspondence to and from the NRC, quality assurance (QA) plan, and topical reports included as reference to the FSAR or correspondence to the NRC. Calculations and analyses that are not in the CLB or not incorporated by reference are not TLAAs. When the code of record is mentioned in the FSAR, for particular groups of structures or components, reference material includes all calculations required by that code of record for those structures and components.

TLAAs that need to be addressed are not necessarily those analyses that have been previously reviewed or approved by the Commission. The following examples illustrate TLAAs that need to be addressed and were not previously reviewed and approved by the Commission:

- The FSAR states that the design complies with a certain national code and standard. A review of the code and standard reveals that a TLAA is required. The actual calculation was performed by the licensee to meet code and standard requirements, the specific calculation was not referenced in the FSAR, and the NRC had not reviewed the calculation.

- In response to a generic letter, a licensee submitted a letter to the NRC committing to perform a TLAA that would address the concern in the generic letter. The NRC had not documented a review of the licensee's response and had not reviewed the actual analysis.

The following examples illustrate analyses that are not TLAAs and need not be addressed under 10 CFR 54.21(c):

- Population projections (Section 2.1.3 of NUREG-0800) (Ref. 2).

- Cost-benefit analyses for plant modifications.

- Analysis with time-limited assumptions defined short of the current operating term of the plant, for example, an analysis for a component based on a service life that would not reach the end of the current operating term.

The number and type of TLAAs vary depending on the plant-specific CLB. All six criteria of TLAAs in 10 CFR 54.3 (and repeated in Subsection 4.1.2 of this review plan section) must be satisfied to conclude that a calculation or analysis is a TLAA. Table 4.1-1 provides examples of how these six criteria may be applied (Ref. 1). Table 4.1-2 provides a list of potential TLAAs (Ref. 1). Table 4.1-3 provides a list of other plant-specific TLAAs that have been identified by the initial license renewal applicants. Table 4.1-2 and 4.1-3 provide examples of analyses that potentially could be TLAAs for a particular plant. However, TLAAs are plant-specific and depend on an applicant's CLB. It is not expected that all applicants would identify all the analyses in these tables as TLAAs for their plants. Also, an applicant may have specific TLAAs for its plant that is not shown in these tables.

The reviewer should use the plant Updated Final Safety Analysis Report (UFSAR) and other CLB documents, such as staff SERs, in performing the review. The reviewer should select analyses that the applicant did not identify as TLAAs. The reviewer may select analyses based on the information in Tables 4.1-2 and 4.1-3 of this review plan section because these analyses have been identified as TLAAs for some plants. In addition, the reviewer may select analyses that are not shown in these tables.

There are staff members from other branches of engineering reviewing the application in their assigned areas separate from the identification of TLAAs. However, they may come across situations where they may have a question on why the applicant did not identify certain analyses within their areas of review as TLAAs. Should this be the case, the reviewer should coordinate the question resolution with these other staff members and determine whether these analyses should be included as TLAAs.

Should an applicant identify a TLAA, which is also a basis for a plant-specific exemption granted pursuant to 10 CFR 50.12 and the exemption is in effect, the reviewer verifies that the applicant

has also identified that exemption pursuant to 10 CFR 54.21(c)(2). However, the initial license renewal applicants have found no such exemptions for their plants.

The reviewer should find no omission by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the TLAAs for its plant.

4.1.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and that the staff evaluation supports conclusions of the following type, to be included in the staffs safety evaluation report, as appropriate.

> The staff concludes that the applicant has provided a list of acceptable TLAAs as defined in 10 CFR 54.3 and that no 10 CFR 50.12 exemptions have been granted on the basis of a TLAA as defined in 10 CFR 54.3.

4.1.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

4.1.6 References

1. NEI 95-10, Revision 1, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Nuclear Energy Institute, January 2000.

2. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports Nuclear Power Plants," July 1981.

Table 4.1-1. Identification of Potential Time-Limited Aging Analyses and Basis for Disposition

Example	Disposition
NRC correspondence requests a utility to justify that unacceptable cumulative wear did not occur during the design life of control rods	Does not qualify as a TLAA because the design life of control rods is less than 40 years. Therefore, does not meet criterion (3) of the TLAA definition in 10 CFR 54.3.
Maximum wind speed of 100 mph is expected to occur once per 50 years.	Not a TLAA. Does not involve an aging effect.
Correspondence from the utility to the NRC states that the membrane on the containment basemat is certified by the vendor to last for 40 years.	This example does not meet criterion (4) of the TLAA definition in 10 CFR 54.3 and therefore is not considered a TLAA. The membrane was not credited in any safety evaluation.
Fatigue usage factor for the pressurizer surge line was determined not to be an issue for the current license period in response to NRC Bulletin 88-11.	This example is a TLAA because it meets all 6 criteria in the definition of TLAA in 10 CFR 54.3. The utility's fatigue design basis relies on assumptions related to 40 year operating life for this component.
Containment tendon lift-off forces are calculated for the 40-year life of the plant. This data is used during Technical Specification surveillance for comparing measured to predicted lift-off forces.	This example is a TLAA because it meets all 6 criteria of the TLAA definition in 10 CFR 54.3. The lift-off force curves are limited to 40-year values currently and are needed to perform a required Technical Specification surveillance.

Table 4.1-2. Potential Time-Limited Aging Analyses

Fatigue
Reactor vessel neutron embrittlement
Environmental aging (Environmental qualification)
Loss of prestress in concrete containment tendons
High density neutron poisons (e.g., Boraflex) of spent fuel racks
Metal corrosion allowance
Inservice flaw growth analyses that demonstrate structure integrity for 40 years
Inservice local metal containment corrosion analyses
High-energy line-break postulation based on fatigue "cumulative usage factor"

Table 4.1-3. Additional Examples of Plant-Specific TLAAs as Identified by the Initial License Renewal Applicants

Intergranular separation in the heat-affected zone (HAZ) of reactor vessel low-alloy steel under austenitic stainless steel cladding. Low-temperature overpressure protection (LTOP) analyses.
Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps.
Main steam isolation valves operating cycles.
Fatigue analysis of the reactor coolant pump flywheel.
Fatigue analysis of polar crane.
Flow-induced vibration endurance limit, transient cycle count assumptions, and ductility reduction of fracture toughness for the reactor vessel internals.
Leak before break.
Fatigue analysis for the containment liner plate.
Containment penetration pressurization cycles.
Reactor vessel circumferential weld inspection relief (BWR).

4.2 Reactor Vessel Neutron Embrittlement

Review Responsibilities

Primary- Branch responsible for materials and chemical engineering
Secondary - Branch responsible for reactor systems

4.2.1 Areas of Review

The fracture toughness of ferritic steel in the reactor vessel beltline region of light-water nuclear power reactors is reduced during plant service neutron irradiation. Areas of review to ensure that the reactor vessel has adequate fracture toughness to prevent brittle failure during normal and off-normal operating conditions are (1) upper-shelf energy, (2) surveillance program, (3) pressurized thermal shock (PTS) for pressurized water reactors (PWRs), (4) heat-up and cool-down (pressure-temperature limits) curves, and (5) boiling water reactor (BWR) Vessel and Internals Project (VIP) VIP-05 analysis for elimination of circumferential weld inspection for BWRs.

The adequacy of the upper-shelf energy analyses and surveillance programs for light-water reactors, the PTS analyses for pressurized water reactors (PWRs), and the heat-up and cool-down (pressure-temperature limits) curves are reviewed for the period of extended operation.

The branch responsible for reactor systems should review neutron fluence and dosimetry information in the application.

4.2.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Subsection 4.2.1 of this review plan section define acceptable methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(c)(1).

4.2.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1)(i) through (iii), an applicant must demonstrate one of the following:

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the extended period of operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Specific acceptance criteria for reactor vessel neutron embrittlement depending on the applicant's choice, i.e., 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.2.2.1.1 Upper-Shelf Energy

Paragraph IV.A.1 in Appendix G (Ref. 1) to 10 CFR Part 50 requires that the reactor vessel beltline materials must have Charpy upper-shelf energy of no less than 68 J (50 ft-lb) throughout the life of the reactor vessel unless otherwise approved by NRC.

4.2.2.1.1.1 10 CFR 54.21 (c)(1)(i)

The existing upper-shelf energy analysis remains valid during the period of extended operation because the neutron fluence projected to the end of the period of extended operation is bounded by the fluence assumed in the existing analysis.

4.2.2.1.1.2 10 CFR 54.21(c)(1)(ii)

The upper-shelf energy is re-evaluated to cover the period of extended operation in accordance with Appendix G to 10 CFR Part 50.

4.2.2.1.1.3 10 CFR 54.21(c)(1)(iii)

Acceptance criteria under 10 CFR 54.21(c)(1)(iii) have yet to be developed and will be evaluated on a case-by-case basis to ensure that the aging effects will be managed such that the intended function(s) will be maintained during the period of extended operation.

4.2.2.1.2 Surveillance Program

Appendix H (Ref. 2) to 10 CFR Part 50 requires the reactor vessel materials surveillance program to meet the American Society for Testing and Materials (ASTM) E 185 Standard (Ref. 3). However, the surveillance program in ASTM E 185 is based on plant operation during the current license term, and additional surveillance capsules may be needed for the period of extended operation. Alternatively, an integrated surveillance program for the period of extended operation may be considered for a set of reactors that have similar design and operating features in accordance with Paragraph II.C of Appendix H to 10 CFR Part 50. Additional surveillance capsules may be needed for the period of extended operation for this alternative also.

4.2.2.1.2.1 10 CFR 54.21(c)(1)(i)

Not applicable. As discussed above, the specified surveillance program does not address the period of extended operation.

4.2.2.1.2.2 10 CFR 54.21(c)(1)(ii)

An applicant may provide additional surveillance capsules in its surveillance program.

Specific acceptance criteria for the surveillance program during the period of extended operation have yet to be developed and will be evaluated on a case-by-case basis.

4.2.2.1.2.3 10 CFR 54.21(c)(1)(iii)

The existing reactor vessel material surveillance program should be evaluated for sufficient material data and dosimetry to monitor irradiation embrittlement at the end of the period of extended operation and need for operating restrictions (that is, inlet temperature, neutron spectrum, and flux). If surveillance capsules are not withdrawn during the period of extended operation, operating restrictions should be established to ensure the plant is operated within the environment of the surveillance capsules.

4.2.2.1.3 Pressurized Thermal Shock (for PWRs)

For PWRs, 10 CFR 50.61 (Ref. 4) requires the "reference temperature RT_{PTS}" for reactor vessel beltline materials be less than the "PTS screening criteria" at the expiration date of the operating license unless otherwise approved by NRC. The "PTS screening criteria" are 132°C (270°F) for plates, forgings, and axial weld materials, or 149°(300°F) for circumferential weld materials. The regulations require updating of the pressurized thermal shock assessment upon a request for a change in the expiration date of a facility's operating license. Therefore, the RT_{PTS} value must be calculated for the reactor life extension period of 48 effective full power years (EFPY).

4.2.2.1.3.1 10 CFR 54.21(c)(1)(i)

The existing PTS analysis remains valid during the period of extended operation because the neutron fluence projected to the end of the period of extended operation is bounded by the fluence assumed in the existing analysis.

4.2.2.1.3.2 10 CFR 54.21(c)(1)(ii)

The PTS analysis is reevaluated to cover the period of extended operation in accordance with 10 CFR 50.61. An analysis is performed in accordance with Regulatory Guide 1.154 (Ref. 5) if the "PTS screening criteria' in 10 CFR 50.61 are exceeded during the period of extended operation.

4.2.2.1.3.3 10 CFR 54.21(c)(1)(iii)

Acceptance criteria under 10 CFR 54.21(c)(1)(iii) have yet to be developed and will be evaluated on a case-by-case basis to ensure that the aging effects will be managed such that the intended function(s) will be maintained during the period of extended operation.

4.2.2.1.4 Pressure-temperature (P-T) limits

10 CFR Part 50, Appendix G (Ref. 1) requires that heatup and cooldown of the reactor pressure vessel be accomplished within established pressure-temperature (P-T) limits. These limits specify the maximum allowable pressure as a function of reactor coolant temperature. As the reactor pressure vessel becomes embrittled and its fracture toughness is reduced, the allowable pressure is reduced. Operation of the reactor coolant system is also limited by the net positive suction curves for the reactor coolant pumps. These curves specify the minimum pressure required to operate the reactor coolant pumps. Therefore, in order to heatup and cooldown, the reactor coolant temperature and pressure must be maintained within an operating window established between the Appendix G P-T limits and the net positive suction curves.

4.2.2.1.4.1 10 CFR 54.21 (c)(1)(i)

The existing P-T limits are valid during the period of extended operation because the neutron fluence projected to the end of the period of extended operation is bounded by the fluence assumed in the existing analysis.

4.2.2.1.4.2 10 CFR 54.21(c)(1)(ii)

The P-T limits are re-evaluated to cover the period of extended operation in accordance with Appendix G to 10 CFR Part 50 (Ref. 1).

4.2.2.1.4.3 10 CFR 54.21(c)(1)(iii)

An operating window should exist between the P-T limits and the net positive suction curves at the end of the period of extended operation. Appendix G to 10 CFR Part 50 requirements will require periodic update of the P-T limits.

4.2.2.1.5 Elimination of Circumferential Weld Inspection (for BWRs)

Some BWRs have been granted relief from the reactor vessel circumferential shell weld inspections for the current license term because they satisfy the limiting conditional failure probability for the circumferential welds at the expiration of the current license based on BWRVIP 05 and the extent of neutron embrittlement (Refs. 6-8). An applicant for such a BWR may provide justification to extend this relief into the period of extended operation. The staff is currently reviewing BWRVIP-74 which addresses license renewal (Ref. 9). If approved by the staff, BWRVIP-74 may provide the basis for granting such relief.

4.2.2.2 FSAR Supplement

The specific criterion for meeting 10 CFR 54.21(d) is:

The summary description of the evaluation of time-limited aging analyses for the period of extended operation in the FSAR supplement provides appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the time-limited aging analysis regarding the basis for determining that aging effects are managed in the period of extended operation.

4.2.3 Review Procedures

For each area of review described in Subsection 4.2.1 of this review plan section, the following review procedures are followed:

4.2.3.1 Time-Limited Aging Analysis

For reactor vessel neutron embrittlement, the review procedures, depending on the applicant's choice, i.e., 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.2.3.1.1 Upper-Shelf Energy

4.2.3.1.1.1 10 CFR 54.21(c)(1)(i)

The projected neutron fluence at the end of the period of extended operation is reviewed to verify that it is bounded by the fluence assumed in the existing upper-shelf energy analysis.

4.2.3.1.1.2 10 CFR 54.21(c)(1)(ii)

The revised upper-shelf energy analysis based on the projected neutron fluence at the end of the period of extended operation is reviewed for compliance with Appendix G to 10 CFR Part 50. An applicant may use Regulatory Guide 1.99, Rev. 2 (Ref. 10), to project upper-shelf energy to the end of the period of extended operation. An applicant may also use Appendix K of

Section XI of the ASME Code (Ref. 11) for evaluating upper-shelf energy. The staff should review the applicant's methodology for this evaluation.

4.2.3.1.1.3 10 CFR 54.21(c)(1)(iii)

The applicant's proposal to demonstrate that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation will be reviewed on a case-by-case basis.

4.2.3.1.2 Surveillance Program

4.2.3.1.2.1 10 CFR 54.21(c)(1)(i)

This option is not applicable.

4.2.3.1.2.2 10 CFR 54.21(c)(1)(ii)

The surveillance program is reviewed for its adequacy during the period of extended operation on a case-by-case basis. If an applicant proposes an integrated surveillance program for the period of extended operation for a set of reactors that have similar design and operating features, the proposal is reviewed for compliance with Paragraph II.C of Appendix H to 10 CFR Part 50.

4.2.3.1.2.3 10 CFR 54.21(c)(1)(iii) (Ref. 12)

1. An applicant may project the extent of reactor vessel embrittlement for upper-shelf energy and pressure-temperature limits for 60 years in accordance with Regulatory Guide 1.99, Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials." When using Regulatory Guide 1.99, Rev. 2, an applicant has a choice of the following:

   (a) Neutron Embrittlement Using Chemistry Tables

   An applicant may use the tables in Regulatory Guide 1.99, Rev. 2, to project the extent of reactor vessel neutron embrittlement for the period of extended operation. This is described as Regulatory Position 1 in the Regulatory Guide.

   (b) Neutron Embrittlement Using Surveillance Data

   When credible surveillance data are available, the extent of reactor vessel neutron embrittlement for the period of extended operation may be projected according to Regulatory Position 2 in Regulatory Guide 1.99, rev. 2. The credible data could be collected during the current operating term. The applicant may have a plant-specific program or an integrated surveillance program during the period of extended operation to collect additional data.

2. For an applicant that determines embrittlement using the Regulatory Guide 1.99 tables [see item 1(a) above], the applicant should use the applicable limitations in Regulatory Position 1.3 of the regulatory guide.

3. For an applicant that determines embrittlement using surveillance data [see item 1(b) above], the applicant should define the applicable bounds of the data, such as cold leg

operating temperature and neutron fluence. These bounds should be specific for the referenced surveillance data and would be more restrictive than the bounds for the Regulatory Guide in item 2 above. For example, the plant-specific data could be collected within a smaller temperature range than that in the regulatory guide.

4. All pulled and tested capsules, unless previously discarded, should be placed in storage. (Note: These specimens are saved for future reconstitution use, in case the surveillance program needs to be re-established.)

5. If an applicant has a surveillance program which consists of capsules with a projected fluence of less than the 60-year fluence at the end of 40 years, at least one capsule should remain in the reactor vessel and should be tested during the period of extended operation. The applicant should either delay withdrawal of their last capsule or withdraw a standby capsule during the period of extended operation to monitor the effects of long-term exposure to neutron irradiation.

6. If an applicant has surveillance program which consists of capsules with a projected fluence exceeding the 60-year fluence at the end of 40 years, the applicant should pull these capsules when they reach the 60-year fluence and test one capsule to meet the requirements of ASTM E185 and place the remaining capsules in storage without testing. Any changes in anticipation of additional renewals, however, should be discussed with the staff.

7. Applicants without in-vessel capsules should have alternative dosimetry to monitor neutron fluence during the period of extended operation, as part of the aging management program for reactor vessel neutron embrittlement.

8. The reactor vessel monitoring program should include that, when future plant operations exceed the limitations or bounds in item 2 or 3 above (as applicable) such as operating at a lower cold leg temperature or higher fluence, the impact of plant operation changes regarding the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. For an applicant without capsules in their reactor vessel, the applicant could propose re-establishing the reactor vessel surveillance program to assess the extent of embrittlement. This program may consist of (1) capsules from item 6 above; (2) reconstitution of specimens from item 4 above; and/or (3) capsules made from any available archival materials. This program could be plant-specific program or an integrated surveillance program.

4.2.3.1.3 Pressurized Thermal Shock (for PWRs)

4.2.3.1.3.1 10 CFR 54.21(c)(1)(i)

The projected neutron fluence at the end of the period of extended operation is reviewed to verify that it is bounded by the fluence assumed in the existing PTS analysis.

4.2.3.1.3.2 10 CFR 54.21(c)(1)(ii)

The revised PTS analysis based on the projected neutron fluence at the end of the period of extended operation is reviewed for compliance with 10 CFR 50.61. There are two methodologies from 10 CFR 50.61 that can be used in the PTS analysis based on the projected neutron fluence at the end of the period of extended operation. RT_{NDT} is the reference

temperature (subscript NDT means nil-ductility temperature) used as an indexing parameter to determine the fracture toughness and the amount of embrittlement of a material. RT_{PTS} is the reference temperature used in the PTS analysis and is related to RT_{NDT} at the end of life.

The first methodology does not rely on plant-specific surveillance data to calculate delta RT_{NDT} (i.e., the mean value of the adjustment or shift in reference temperature caused by irradiation). The delta RT_{NDT} is determined by multiplying a chemistry factor from the tables in 10 CFR 50.61 by a fluence factor calculated from the neutron flux using an equation.

The second methodology relies on plant-specific surveillance data to determine the delta RT_{NDT}. In this methodology, two or more sets of surveillance data are needed. Surveillance data consists of a measured delta RT_{NDT} for a corresponding neutron fluence. 10 CFR 50.61 specifies a procedure and a criterion for determining whether the surveillance data are credible, e.g., the difference in the predicted value and the measured value for delta RT_{NDT} must be less than 28°F for weld metal for the surveillance data to be defined as credible. When a credible surveillance data set exists, the chemistry factor determined from the surveillance data can be used in lieu of the values in the table in 10 CFR 50.61 and the standard deviation of the increase in the RT_{NDT} can be reduced from 28°F to 14°F for welds.

If the "PTS screening criteria" in 10 CFR 50.61 are exceeded during the period of extended operation, an analysis based on Regulatory Guide 1.154 is reviewed.

4.2.3.1.3.3 10 CFR 54.21(c)(1)(iii)

The applicant's proposal to demonstrate that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation will be reviewed on a case-by-case basis. If the projected reference temperature exceeds the screening criterion established in 10 CFR 50.61, the licensee is required to implement such flux reduction programs as are reasonably practicable to avoid exceeding the screening criterion. The schedule for implementation of such programs may take into account the schedule and anticipated approval by the Director, NRR, of detailed plant-specific analyses to demonstrate acceptable risk with RT_{PTS} above the screening limit. If the licensee cannot avoid exceeding the screening criteria by using a flux reduction program, it must submit a safety analysis to determine what actions are necessary to prevent potential failure of the reactor vessel. 10 CFR 50.61 also permits the licensee to perform a thermal annealing treatment to recover fracture toughness, subject to the requirements of 10 CFR 50.66.

4.2.3.1.4 Pressure-temperature (P-T) limits

4.2.3.1.4.1 10 CFR 54.21(c)(1)(i)

The projected neutron fluence at the end of the period of extended operation is reviewed to verify that it is bounded by the embrittlement assumed in the existing P-T limit analysis.

4.2.3.1.4.2 10 CFR 54.21(c)(1)(ii)

The revised P-T limit analysis based on the projected reduction in fracture toughness at the end of the period of extended operation is reviewed for compliance with 10 CFR Part 50, Appendix G.

4.2.3.1.4.3 10 CFR 54.21(c)(1)(iii)

In order to heatup and cooldown, the reactor coolant temperature and pressure must be maintained within an operating window established between the Appendix G P-T limits and the net positive suction curves. The reviewer verifies that the applicant has provided information to indicate that such an operating window should exist and is sufficient to conduct heatups and cooldowns at the end of the period of extended operation. Appendix G to 10 CFR Part 50 requires periodic update of P-T limits based on projected embrittlement and data from material surveillance program. Thus, the applicant's surveillance program will provide data to update the P-T limits and will manage the reduction in fracture toughness.

4.2.3.1.5 Elimination of Circumferential Weld Inspection (for BWRs)

Some BWRs have been granted relief from the reactor vessel circumferential shell weld inspections for the current license term because they satisfy the limiting conditional failure probability for the circumferential welds at the expiration of the current license based on BWRVIP 05 and the extent of neutron embrittlement (Refs. 6-8). An applicant for such a BWR may provide justification to extend this relief into the period of extended operation. The staff is currently reviewing BWRVIP-74 which supercedes BWRVIP-05 and addresses license renewal (Ref. 9). If approved by the staff, BWRVIP-74 may provide the basis for granting such relief.

When available, an applicant may reference the approved BWRVIP-74 as its basis for requesting the continuation of the relief to the end of the period of extended operation. The staff should review to ensure that the applicant's plant is bounded by the BWRVIP-74 analysis and that the applicant has committed to actions that are the basis for the staff approval of BWRVIP 74.

4.2.3.2 FSAR Supplement

The reviewer verifies that the applicant has provided a FSAR supplement on the summary description of the evaluation of the reactor vessel neutron embrittlement TLAA. Table 4.2-1 of this review plan section contains examples of acceptable FSAR supplement information for this TLAA. The reviewer verifies that the applicant has provided a FSAR supplement using a format similar to that in Table 4.2-1.

4.2.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and that the staff's evaluation supports conclusions of the following type depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), to be included in the staff's safety evaluation report.

> The staff evaluation concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the reactor vessel neutron embrittlement TLAA, (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the reactor vessel neutron embrittlement TLAA evaluation for the period of extended operation.

4.2.5 IMPLEMENTATION

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

4.2.6 References

1. 10 CFR Part 50 Appendix G, "Fracture Toughness Requirements."

2. 10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."

3. ASTM E 185, "Standard Practice of Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," American Society for Testing and Materials, 1982.

4. 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events."

5. Regulatory Guide 1.154, "Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors," January 1987.

6. BWRVIP-05, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)," Boiling Water Reactor Owners Group, September 28, 1995.

7. Letter to Carl Terry of Niagara Mohawk Power Company, from Gus C. Lainas of NRC, dated July 28, 1998.

8. Generic Letter 98-05, "Boiling Water Reactor Licensees Use of the BWRVIP-05 Report to Request Relief from Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds," Nuclear Regulatory Commission, November 10, 1998.

9. BWRVIP-74, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," Boiling Water Reactor Owners Group.

10. Regulatory Guide 1.99 Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials," May, 1988.

11. Appendix K of ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components."

12. Letter from C. I. Grimes (NRC) to D. J. Walters (NEI), License Renewal Issue No. 98-0085, "Reactor Vessel Surveillance Program," dated Dec 3, 1999.

Table 4.2-1. Examples of FSAR Supplement for Reactor Vessel Neutron Embrittlement TLAA Evaluation

TLAA	Description of Evaluation	Implementation Schedule
Upper-shelf energy	Paragraph IV.A.1 in Appendix G to 10 CFR Part 50 requires that the reactor vessel beltline materials must have Charpy upper-shelf energy of no less than 50 ft-lb throughout the life of the reactor vessel unless otherwise approved by the NRC. The upper-shelf energy has been determined to exceed 50 ft-lb to the end of the period of extended operation.	Completed
Surveillance program	Irradiating and testing of metallurgical samples are used to monitor the progress of neutron embrittlement as a function of neutron fluence. The current program is in accordance with ASTM E 185. The program consists of 6 capsules in each unit, with 2 capsules tested, 3 capsules to be tested, and one standby capsule. The withdrawal schedule will be revised to provide data at neutron fluence equal to or greater than the projected peak fluence at the end of the license renewal period. If the last capsule is withdrawn before year 55, will establish reactor vessel neutron environment conditions applicable to the surveillance data. If the plant operates outside of the limits established by these conditions, will inform the NRC and determine the impact of the condition on reactor vessel integrity. If the last capsule is withdrawn before year 55, will install neutron dosimetry to permit tacking of the fluence to the reactor vessel.	The surveillance capsule withdrawal schedule will be revised by....
Pressurized thermal shock (for PWRs)	For PWRs, 10 CFR 50.61 requires the "reference temperature RT_{PTS}" for reactor vessel beltline materials be less that the "PTS screening criteria" at the expiration date of the operating license unless otherwise approved by the NRC. The "PTS screening criteria" are 270 ^{0}F for plates, forgings, and axial weld materials, or 300 ^{0}F for circumferential weld materials. The "reference temperature" has been determined to be less than the "PTS screening criteria" at the end of the period of extended operation.	Completed
Pressure-temperature (P-T) limits	Appendix G to 10 CFR Part 50 requires that heatup and cooldown of the reactor pressure vessel be accomplished within established P-T limits. These limits specify the maximum allowable pressure as a function of	Update as required by Appendix G to 10 CFR Part 50

	reactor coolant temperature. As the reactor pressure vessel becomes embrittled and its fracture toughness is reduced, the allowable pressure is reduced. Appendix G to 10 CFR Part 50 requires periodic update of P-T limits based on projected embrittlement and data from material surveillance program.	
Elimination of circum-ferential weld inspection (for BWRs)	NRC has granted relief from the reactor vessel circumferential shell weld inspections, because the plant has been demonstrated to meet BWRVIP-74 as approved by the NRC.	Completed

4.3 METAL FATIGUE

Review Responsibilities

Primary- Branch responsible for mechanical engineering
Secondary- None

4.3.I Areas of Review

A metal component subjected to cyclic loading at loads less than the static design load may fail because of fatigue. Metal fatigue of components may have been evaluated based on an assumed number of transients or cycles for the current operating term. The validity of such metal fatigue analysis is reviewed for the period of extended operation.

4.3.1.1 Time-Limited Aging Analysis

Metal components may be designed or analyzed based on guidance in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code or the American National Standards Institute (ANSI) requirements. These codes contain explicit metal fatigue or cyclic considerations based on time-limited aging analyses.

4.3.1.1.1 ASME Section III, Class 1

ASME Class 1 components, which include core support structures, are analyzed for metal fatigue. ASME Section III (Ref. 1) requires a fatigue analysis for Class 1 components considering all transient loads based on the anticipated number of transients. A Section III Class 1 fatigue analysis requires the calculation of the "cumulative usage factor" (CUF) based on the fatigue properties of the materials and the expected fatigue service of the component. The ASME Code limits the CUF to a value of less than unity for acceptable fatigue design. The fatigue resistance of these components during the period of extended operation is an area of review.

4.3.1.1.2 ANSI B31.1

ANSI B31.1 (Ref. 2) does not require an explicit fatigue analysis. It specifies allowable stress levels based on the number of anticipated thermal cycles. ANSI B31.1 applies only to piping. The specific allowable stress reductions due to thermal cycles are listed in Table 4.3-1. For example, the allowable stress would be reduced by a factor of 1.0, that is, no reduction, for piping that is not expected to experience more than 7,000 thermal cycles during plant service but would be reduced to half of the maximum allowable static stress for 100,000 or more thermal cycles. The fatigue resistance of these components during the period of extended operation is an area of review.

4.3.1.1.3 Other Evaluations Based on CUF

The codes also contain metal fatigue analysis requirements based on a CUF calculation [the 1969 edition of ANSI B31.7 (Ref. 3) for Class 1 piping, ASME NC-3200 vessels, ASME NE-3200 Class MC components, and metal bellows designed to ASME NC-3649.4(e)(3), ND-3649.4(e)(3), or NE-3366.2(e)(3)]. For these components, the discussion relating to ASME Section III, Class 1 in Subsection 4.3.1.1.1 of this review plan section applies.

4.3.1.1.4 ASME Section III, Class 2 and 3

ASME Section III, Class 2 and 3 piping cyclic design requirements are similar to those for ANSI B31.1. The discussion relating to B31.1 in Subsection 4.3.1.1.2 of this review plan section applies.

4.3.1.2 Generic Safety Issue

The fatigue design criteria for nuclear power plant components has changed as the industry consensus codes and standards have evolved. The fatigue design criteria for a specific component depend on the version of the design code that applied to that component, that is, the code of record. There is a concern that the effects of the reactor coolant environment on the fatigue life of component was not adequately addressed by the code of record.

The Commission has decided that the adequacy of the code of record relating to metal fatigue is a potential safety issue to be addressed by the current regulatory process for operating reactors (Refs. 4 and 5). The effects of fatigue for the initial 40-year initial reactor license period were studied and resolved under Generic Safety Issue (GSI)-78, "Monitoring of Fatigue Transient Limits for Reactor Coolant System," and GSI-166, "Adequacy of Fatigue Life of Metal Components" (Ref. 6). GSI-78 addressed whether fatigue monitoring was necessary at operating plants. As part of the resolution of GSI-166, an assessment was made of the significance of the more recent fatigue test data on the fatigue life of a sample of components in plants were Code fatigue design analysis had been performed. The efforts on fatigue life estimation and ongoing issues under GSI-78 and GSI-166 for 40-year plant life were addressed separately under a staff generic task action plan (Refs. 7 and 8). The staff documented its completion of the fatigue action plan in SECY-95-245 (Ref. 9).

SECY-95-245 was based on a study described in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components" (Ref. 10). In NUREG/CR-6260, sample locations in the plant with high fatigue usage were evaluated. Conservatisms in the original fatigue calculations, such as actual cycles versus assumed cycles, were removed and the fatigue usage was recalculated using a fatigue curve considering the effects of the environment. The staff found that most of the locations would have a CUF of less than the ASME Code limit of 1.0 for 40 years. On the basis of the component assessments, supplemented by a 40-year risk study, the staff concluded that a backfit of the environmental fatigue data to operating plants could not be justified. However, because the staff was less certain that sufficient excessive conservatisms in the original fatigue calculations could be removed to account for an additional 20 years of operation for renewal, the staff recommended in SECY-95-245 that the samples in NUREG/CR-6260 should be evaluated considering environmental effects for license renewal. GSI-190, "Fatigue Evaluation of Metal Components for 60-year Plant Life," was established to address the residual concerns of GSI-78 and GSI-166 regarding the environmental effects on fatigue on pressure boundary components for 60-years of plant operation.

The scope of GSI-190 included design basis fatigue transients, studying the probability of fatigue failure and its effect on core damage frequency (CDF) of selected metal components for 60-year plant life. The study showed that some components have cumulative probabilities of crack initiation and through-wall growth that approach unity within the 40- and 60-year period. The maximum failure rate (through-wall cracks per year) was in the range of 10^{-2} per year, and those failures were generally associated with high cumulative usage factor locations and components with thinner walls, i.e., pipes more vulnerable to through-wall cracks. In most cases, the leakage from these through-wall cracks is small and not likely to lead to core damage. Based on the results of probabilistic analyses, along with the sensitivity studies performed, the

interactions with the industry (NEI and EPRI), and different approaches available to the licensees to manage the effects of aging, it was concluded that no generic regulatory action is required, and that GSI-190 is resolved (Ref. 11). However, the calculations supporting resolution of this issue, which included consideration of environmental effects, and the nature of age-related degradation indicate the potential for an increase in the frequency of pipe leaks as plants continue to operate. Thus, the staff concluded that licensees must address the effects of coolant environment on component fatigue life as aging management programs are formulated in support of license renewal.

An applicant's consideration of the effects of coolant environment on component fatigue life for license renewal is an area of review.

4.3.1.3 FSAR Supplement

Detailed information on the evaluation of time-limited aging analyses is contained in the renewal application. A summary description of the evaluation of time-limited aging analyses for the period of extended operation is contained in the applicant's final safety analysis report (FSAR) supplement. The FSAR supplement is an area of review.

4.3.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Subsection 4.3.1 of this review plan section define acceptable methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(c)(1).

4.3.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1)(i) through (iii), an applicant must demonstrate one of the following:

(i) the analyses remain valid for the period of extended operation,

(ii) the analyses have been projected to the end of the extended period of operation, or

(iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Specific acceptance criteria for metal fatigue are:

4.3.2.1.1 ASME Section III, Class 1

For components designed or analyzed to ASME Class 1 requirements, the acceptance criteria, depending on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.3.2.1.1.1 10 CFR 54.21(c)(1)(i)

The existing CUF calculations remain valid because the number of assumed transients would not be exceeded during the period of extended operation.

4.3.2.1.1.2 10 CFR 54.21(c)(1)(ii)

The CUF calculations have been re-evaluated based on an increased number of assumed transients to bound the period of extended operation. The resulting CUF remains less than unity as required by the code during the period of extended operation.

4.3.2.1.1.3 10 CFR 54.21(c)(1)(iii)

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The component could be replaced and the CUF for the replacement will be less than unity during the period of extended operation.

Alternative acceptance criteria under 10 CFR 54.21(c)(1)(iii) have yet to be developed and will be evaluated on a case-by-case basis to ensure that the aging effects will be managed such that the intended functions(s) will be maintained during the period of extended operation.

4.3.2.1.2 ANSI B31.1

For piping designed or analyzed to B31.1 requirements, the acceptance criteria, depending on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.3.2.1.2.1 10 CFR 54.21(c)(1)(i)

The existing allowable stresses remain valid because the number of assumed thermal cycles would not be exceeded during the period of extended operation.

4.3.2.1.2.2 10 CFR 54.21(c)(1)(ii)

The allowable stresses have been re-evaluated based on an increased number of assumed thermal cycles and Table 4.3-1 to bound the period of extended operation. The resulting allowable stresses remain sufficient as required by the code during the period of extended operation.

4.3.2.1.2.3 10 CFR 54.21(c)(1)(iii)

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The component could be replaced and the allowable stresses for the replacement will be sufficient as required by the code during the period of extended operation.

Alternative acceptance criteria under 10 CFR 54.21(c)(1)(iii) have yet to be developed and will be evaluated on a case-by-case basis to ensure that the aging effects will be managed such that the intended functions(s) will be maintained during the period of extended operation.

4.3.2.1.3 Other Evaluations Based on CUF

The acceptance criteria in Subsection 4.3.2.1.1 of this review plan section apply.

4.3.2.1.4 ASME Section III, Class 2 and 3

The acceptance criteria in Subsection 4.3.2.1.2 of this review plan section apply.

4.3.2.2 Generic Safety Issue

The staff recommendation for the closure of GSI–190 is contained in a December 26, 1999, memorandum from Ashok Thadani to William Travers (Ref. 11). The staff recommended that licensees address the effects of the coolant environment on component fatigue life as aging management programs are formulated in support of license renewal. One method acceptable to the staff of satisfying this recommendation is to assess the impact of the reactor coolant environment on a sample of critical components. These critical components should include, as a

minimum, those components selected in NUREG/CR–6260 (Ref. 10). The sample of critical components can be evaluated by applying environmental correction factors to the existing ASME Code fatigue analyses. Formulas for calculating the environmental life correction factors for carbon and low–alloy steels are contained in NUREG/CR–6583 (Ref. 12) and those for austenitic stainless steels are contained in NUREG/CR–5704 (Ref. 13).

4.3.2.3 FSAR Supplement

The specific criterion for meeting 10 CFR 54.21(d) is:

The summary description of the evaluation of time-limited aging analyses for the period of extended operation in the FSAR supplement provides appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the time-limited aging analysis regarding the basis for determining that aging effects are managed in the period of extended operation.

4.3.3 Review Procedures

For each area of review described in Subsection 4.3.1 of this review plan section, the following review procedures are followed:

4.3.3.1 Time-Limited Aging Analysis

4.3.3.1.1 ASME Section III, Class 1

For components designed or analyzed to ASME Class 1 requirements, the review procedures, depending on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.3.3.1.1.1 10 CFR 54.21(c)(1)(i)

A list of the assumed transients used in the existing CUF calculations for the current operating term and operating transient experience is reviewed to ensure that the number of assumed transients would not be exceeded during the period of extended operation.

4.3.3.1.1.2 10 CFR 54.21(c)(1)(ii)

A list of the increased number of assumed transients projected to the end of the period of extended operation and operating transient experience is reviewed to ensure that the transient projection is adequate. The revised CUF calculations based on the projected number of assumed transients are reviewed to ensure that the CUF remains less than unity at the end of the period of extended operation.

The code of record should be used for the re-evaluation, or the applicant may update to a later code edition pursuant to 10 CFR 50.55a. In the latter case, the reviewer verifies that the requirements in 10 CFR 50.55a are met.

4.3.3.1.1.3 10 CFR 54.21(c)(1)(iii)

The applicant's proposed program to ensure that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation is reviewed. If the applicant proposed component replacement before its CUF exceeds unity, the reviewer verifies that the CUF for the replacement will remain less than unity during the period of extended operation.

Other applicant proposed programs will be reviewed on a case-by-case basis.

4.3.3.1.2 ANSI B31.1

For piping designed or analyzed to ANSI B31.1 requirements, the review procedures, depending on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.3.3.1.2.1 10 CFR 54.21(c)(1)(i)

A list of the assumed thermal cycles used in the existing allowable stress determination and operating cyclic experience is reviewed to ensure that the number of assumed thermal cycles would not be exceeded during the period of extended operation.

4.3.3.1.2.2 10 CFR 54.21(c)(1)(ii)

A list of the increased number of assumed thermal cycles projected to the end of the period of extended operation and operating cyclic experience is reviewed to ensure that the thermal cycle projection is adequate. The revised allowable stresses based on the projected number of assumed thermal cycles and Table 4.3-1 are reviewed to ensure that they remain sufficient as required by the code during the period of extended operation.

The code of record should be used for the re-evaluation or the applicant may update to a later code edition pursuant to 10 CFR 50.55a. In the latter case, the reviewer verifies that the requirements in 10 CFR 50.55a are met.

4.3.3.1.2.3 10 CFR 54.21(c)(1)(iii)

The applicant's proposed program to ensure that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation is reviewed. If the applicant proposed component replacement before it exceeds the assumed thermal cycles, the reviewer verifies that the allowable stresses for the replacement will remain sufficient as required by the code during the period of extended operation. Other applicant-proposed programs will be reviewed on a case-by-case basis.

4.3.3.1.3 Other Evaluations Based on CUF

The review procedures in Subsection 4.3.3.1.1 of this review plan section apply.

4.3.3.1.4 ASME Section III, Class 2 and 3

The review procedures in Subsection 4.3.3.1.2 of this review plan section apply.

4.3.3.2 Generic Safety Issue

The reviewer verifies that the applicant has addressed the staff recommendation for the closure of GSI–190 contained in a December 26, 1999, memorandum from Ashok Thadani to William Travers (Ref. 11). The reviewer verifies that the applicant has addressed the effects of the coolant environment on component fatigue life as aging management programs are formulated in support of license renewal. If an applicant has chosen to assess the impact of the reactor coolant environment on a sample of critical components, the reviewer verifies the following:

1. The critical components include, as a minimum, those components selected in NUREG/CR–6260 (Ref. 10).

2. The sample of critical components have been evaluated by applying environmental correction factors to the existing ASME Code fatigue analyses.

3. Formulas for calculating the environmental life correction factors are those contained in NUREG/CR–6583 (Ref. 12) for carbon and low–alloy steels, and in NUREG/CR–5704 (Ref. 13) for austenitic stainless steels.

4.3.3.3 FSAR Supplement

The reviewer verifies that the applicant has provided a FSAR supplement on the summary description of the evaluation of the metal fatigue TLAA. Table 4.3-2 of this review plan section contains examples of acceptable FSAR supplement information for this TLAA. The reviewer verifies that the applicant has provided a FSAR supplement using a format similar to that in Table 4.3-2.

4.3.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and that the staff's evaluation supports conclusions of the following type depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), to be included in the staff's safety evaluation report.

> The staff evaluation concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the metal fatigue TLAA, (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the metal fatigue TLAA evaluation for the period of extended operation.

4.3.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

4.3.6 References

1. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Power Plant Components," American Society of Mechanical Engineers.

2. ANSI/ASME B31.1, "Power Piping," American National Standards Institute.

3. ANSI/ASME B31.7-1969, "Nuclear Power Piping," American National Standards Institute.

4. SECY-93-049, "Implementation of 10 CFR Part 54, 'Requirements for Renewal of Operating Licenses for Nuclear Power Plants,'" March 1, 1993.

5. Staff Requirements Memorandum from Samuel J. Chilk, dated June 28, 1993.

6. NUREG-0933, "A Prioritization of Generic Safety Issues," Supplement 20, July 1996.

7. Letter from William T. Russell of NRC to William Rasin of the Nuclear Management and Resources Council, dated July 30, 1993.

8. SECY-94-191, "Fatigue Design of Metal Components," July 26, 1994.

9. SECY-95-245, "Completion of The Fatigue Action Plan," September 25, 1995.

10. NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," March 1995.

11. Letter from Ashok C. Thadani of the Office of Nuclear Regulatory Research to William D. Travers, Executive Director of Operations, dated December 26, 1999.

12. NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low–Alloy Steels," March 1998.

13. NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," April 1999.

Table 4.3-1. Stress Range Reduction Factors

Number of Equivalent Full Temperature Cycles	Stress Range Reduction Factor
7,000 and less	1.0
7,000 to 14,000	0.9
14,000 to 22,000	0.8
22,000 to 45,000	0.7
45,000 to 100,000	0.6
100,000 and over	0.5

Table 4.3-2. Examples of FSAR Supplement for Metal Fatigue TLAA Evaluation

TLAA	Description of Evaluation	Implementation Schedule
Metal Fatigue	In order not to exceed the design limit on fatigue usage and the number of design cycles, the aging management program monitors and tracks the number of critical thermal and pressure test transients, and monitors the cycles for the selected reactor coolant system components. The aging management program will address the effects of the coolant environment on component fatigue life by assessing the impact of the reactor coolant environment on a sample of critical components that include, as a minimum, those components selected in NUREG/CR–6260. The sample of critical components can be evaluated by applying environmental correction factors to the existing ASME Code fatigue analyses. Formulas for calculating the environmental life correction factors are contained in NUREG/CR–6583 for carbon and low–alloy steels and in NUREG/CR–5704 for austenitic stainless steels.	Evaluation will be completed by...

4.4 Environmental Qualification (EQ) of Electric Equipment

Review Responsibilities

Primary - Branch responsible for electrical engineering
Secondary - None

4.4.1 Areas of Review

Electric equipment important to safety that is environmentally qualified is required to remain functional during normal plant operation and during and following design basis events to ensure safe operation, achieve and maintain safe shutdown, or prevent or mitigate accidents. Environmental qualification (EQ) of this equipment has been demonstrated by testing, analysis in combination with partial type test data, and/or operating experience with identical or similar equipment for the current operating term. The validity of EQ for this equipment is reviewed for the period of extended operation.

4.4.1.1 Time-Limited Aging Analysis

Specific requirements pertaining to qualification of certain electric equipment important to safety are contained in 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." Regulatory Guide 1.89, Rev. 1, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," (Ref. 1) supports 10 CFR 50.49. The EQ rule (10 CFR 50.49) is based on the Division of Operating Reactors (DOR) Guidelines (Ref. 2) and NUREG-0588 (Ref. 3). The principal nuclear industry qualification standards for electric equipment are IEEE STD. 323-1971 (Ref. 4) and IEEE STD. 323-1974 (Ref. 5). These codes and standards contain explicit EQ considerations based on time-limited aging analyses.

4.4.1.1.1 DOR Guidelines

The qualification of electric equipment that is subject to significant known degradation due to aging where a qualified life was previously established will be reviewed for the period of extended operation to the requirements of Section 5.2.4 of the DOR Guidelines.

4.4.1.1.2 NUREG-0588, CATEGORY II (IEEE STD. 323-1971)

The qualification of programs that are committed to conform to the requirements of IEEE STD. 382-1972 (Ref. 6) (for valve operators) and IEEE STD. 334-1971(Ref. 7) (for motors) will be reviewed for the period of extended operation against Category II requirements in NUREG-0588.

4.4.1.1.3 NUREG-0588, CATEGORY I (IEEE STD. 323-1974)

The qualification of certain electric equipment important to safety that is subject to the requirements of NUREG-0588, Category I, will be reviewed for the period of extended operation to assess the validity of the extended qualification.

4.4.1.2 Generic Safety Issue

The EQ requirements differ for newer and older plants. The Commission has decided that the adequacy of EQ is a potential safety issue to be addressed by the current regulatory process for operating reactors (Refs. 8 and 9). Generic Safety Issue (GSI) 168, "Environmental Qualification of Electrical Equipment," (Ref. 10) is being addressed separately under a generic task action plan (Refs. 11 and 12). Industry data on cables have been reviewed (Ref. 13). The staff continues to make progress in the cable research program, including the investigation of condition monitoring techniques to predict the condition and accident survivability of cables.

An applicant's consideration of GSI-168 for license renewal is an area of review.

4.4.1.3 FSAR Supplement

The detailed information on the evaluation of time-limited aging analyses is contained in the renewal application. A summary description of the evaluation of time-limited aging analyses for the period of extended operation is contained in the applicant's final safety analysis report (FSAR) supplement. The FSAR supplement is an area of review.

4.4.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Subsection 4.4.1 of this review plan section define acceptable methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(c)(1).

4.4.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1)(i) through (iii), an applicant must demonstrate one of the following:

(i) the analyses remain valid for the period of extended operation,

(ii) the analyses have been projected to the end of the extended period of operation, or

(iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Specific acceptance criteria for EQ of certain electric equipment important to safety analyzed to Section 5.2.4 of the DOR Guidelines; NUREG-5088, Category II (Section 4); or NUREG-0588, Category I (depending on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii))are:

4.4.2.1.1 10 CFR 54.21(c)(1)(i)

The existing qualification is based on previous testing, analysis, and operating experience or combinations thereof that demonstrate that the equipment is qualified for the period of extended operation.

4.4.2.1.2 10 CFR 54.21(c)(1)(ii)

Qualification of the equipment is extended for the period of extended operation by testing, analysis, and operating experience or combinations thereof in accordance with the CLB requirements.

4.4.2.1.3 10 CFR 54.21(c)(1)(iii)

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The equipment could be replaced prior to reaching the end of its qualified life. The EQ process is considered an aging management program for license renewal.

4.4.2.2 Generic Safety Issue

One acceptable approach is to provide a technical rationale demonstrating that the current licensing basis for EQ will be maintained in the period of extended operation. (Ref. 14)

4.4.2.3 FSAR Supplement

The specific criterion for meeting 10 CFR 54.21(d) is:

The summary description of the evaluation of time-limited aging analyses for the period of extended operation in the FSAR supplement provides appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the time-limited aging analysis regarding the basis for determining that aging effects are managed in the period of extended operation.

4.4.3 Review Procedures

For each area of review described in Subsection 4.4.1 of this review plan section, the following review procedures are followed:

4.4.3.1 Time-Limited Aging Analysis

For electric equipment qualified to the requirements of 10 CFR 50.49, the review procedures, depending on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.4.3.1.1 10 CFR 54.21(c)(1)(i)

The documented results, test data, analyses, etc., of previous qualification by an appropriate combination of testing, analysis, and operating experience are reviewed such that it is determined that the original qualified life bounds the period of extended operation.

4.4.3.1.2 10 CFR 54.21(c)(1)(ii)

The results of extending the qualification for the period of extended operation will be reviewed. The qualification methods include testing, analysis, operating experience or combinations thereof. For reanalysis, the reviewer verifies that an applicant has addressed attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. (Ref. 15)

4.4.3.1.3 10 CFR 54.21 (c)(1)(iii)

The applicant's EQ process will be reviewed to ensure that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation because the equipment will be replaced prior to reaching the end of its qualified life. Replacement equipment must be qualified in accordance with the provisions of 10 CFR 50.49. For reanalysis, the reviewer verifies that an applicant has addressed attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. (Ref. 15)

4.4.3.2 Generic Safety Issue

For license renewal, the Statements of Consideration (SOC) for the amended license renewal rule (60 FR 22484) provide four approaches that could be used to satisfy the finding required by 10 CFR 54.29. With respect to addressing GSI-168 for license renewal, until completion of an ongoing research program and staff evaluations, the potential issues associated with GSI-168 and their scope have not been defined to the point that a license renewal applicant can reasonably be expected to address them at this time. Therefore, an acceptable approach described in the SOC is to provide a technical rationale demonstrating that the current licensing basis for EQ pursuant to 10 CFR 50.49 will be maintained in the period of extended operation. Although the SOC also indicates that an applicant should provide a brief description of one or more reasonable options that would be available to adequately manage the effects of aging, the reviewer should not expect an applicant to provide the options at this time. A renewal applicant should monitor updates to NUREG-0933, "A Prioritization of Generic Safety Issues," for revisions to GSI-168 during the review of its application and supplement its license renewal application if the issues associated with GSI-168 become defined such that providing the options or pursuing one of the other approaches described in the SOC becomes feasible (Ref.14).

4.4.3.3 FSAR Supplement

The reviewer verifies that the applicant has provided a FSAR supplement on the summary description of the evaluation of EQ Electric Equipment TLAA. Table 4.4-1 of this review plan section contains examples of acceptable FSAR supplement information of this TLAA. The reviewer verifies that the applicant has provided a FSAR supplement using a format similar to that in Table 4.4-1.

4.4.4 Evaluation of Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and that the staff's evaluation supports conclusions of the following type depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), (iii), to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.2 (c)(1), that, for the EQ of Electric Equipment, (i) the analyses remain valid for the period of extended operation. (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also

concludes that the FSAR supplement contains an appropriate summary description of the EQ of Electric Equipment TLAA evaluation for the period of extended operation.

4.4.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specific portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

4.4.6 References

1. Regulatory Guide 1.89, Rev. 1, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," June 1984.

2. "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors," (DOR Guidelines), November 1979.

3. NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Equipment," July 1981.

4. IEEE STD. 323-1971, "IEEE Trial Use Standard; General Guide for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

5. IEEE STD. 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

6. IEEE STD. 382-1972, "Standard for Qualification of Actuators for Power Operated Valve Assemblies with Safety Related Functions for Nuclear Power Plants."

7. IEEE STD. 334-1971, "IEEE Standard for Type Tests of Continuous Duty Class 1E Motors for Nuclear Power Generating Stations."

8. SECY-93-049, "Implementation of 10 CFR Part 54, 'Requirements for Renewal of Operating Licenses for Nuclear Power Plants,'" March 1, 1993.

9. Staff Requirements Memorandum from Samuel J. Chilk, dated June 28, 1993.

10. NUREG-0933, "A Prioritization of Generic Safety Issues," Supplement 20, July 1996.

11. Letter from William T. Russell of NRC to William Rasin of the Nuclear Management and Resources Council, dated July 30, 1993.

12. Memorandum from James M. Taylor of NRC to the Commission, "Environmental Qualification of Electric Equipment," dated April 8, 1994.

13. NUREG/CR-6384, Volumes 1 and 2, "Literature Review of Environmental Qualification of Safety-Related Electric Cables," April 1996.

14. Letter from Christopher I. Grimes (NRC) to Doug Walters (NEI), " Guidance on addressing GSI-168 for license renewal", dated June 2, 1998.

15. NUREG-xxxx, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, XXXX.

Table 4.4-1. Examples of FSAR Supplement for Environmental Qualification (EQ) of Electric Equipment TLAA Evaluation

10 CFR 54.21(c)(1)(i) Example

TLAA	Description of Evaluation	Implementation Schedule
Environmental qualification (EQ) of electric equipment	The original EQ qualified life has been shown to bound the period of extended operation.	Completed

10 CFR 54.21(c)(1)(ii) Example

TLAA	Description of Evaluation	Implementation Schedule
Environmental qualification (EQ) of electric equipment	The EQ qualification has been extended to cover the period of extended operation. Re-analysis addressed attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions.	Completed

10 CFR 54.21(c)(1)(iii) Example

TLAA	Description of Evaluation	Implementation Schedule
Environmental qualification (EQ) of electric equipment	The existing EQ process, in accordance with 10 CFR 50.49, will adequately manage aging of EQ equipment for the period of extended operation because equipment will be replaced prior to reaching the end of its qualified life. Re-analysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the re-analysis will be completed.	Existing program

4.5 CONCRETE CONTAINMENT TENDON PRESTRESS

Review Responsibilities

Primary - Branch responsible for structural engineering
Secondary - None

4.5.1 Areas of Review

The prestressing forces in prestressed concrete containments lose their prestressing forces with time due to creep and shrinkage of concrete, and relaxation of prestressing steel. During the design phase, engineers estimate these losses to arrive at the predicted prestressing forces at the end of operating life (Refs. 1 and 2), normally forty years. The experiences with the trend of prestressing forces indicate that the prestressing tendons lose their prestressing forces at a rate higher than estimated (Ref. 3). Thus, it is necessary to perform time limited aging analysis (TLAA) for the extended period of operation.

The adequacy of the prestressing forces in prestressed concrete containments is reviewed for the period of extended operation.

4.5.2 Acceptance Criteria

The acceptance criterion for the TLAA described in Subsection 4.5.1 of this review plan section are as follows:

The trend lines of the actually measured prestressing forces in each group of tendons to remain above the predicted lower limits (PLL) (Ref. 2) for the period of extended operation.

4.5.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1)(i) through (iii), an applicant must demonstrate one of the following:

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the extended period of operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Accordingly, the specific options for satisfying the acceptance criterion are:

4.5.2.1.1 10 CFR 54.21(c)(1)(i)

The existing prestressing force evaluation remains valid because (1) losses of the prestressing force are less than the predicted losses as evidenced from the trend lines constructed from the recent inspection, (2) the period of evaluation covers the period of extended operation, and (3) the trend lines of the measured prestressing forces remain above the predicted lower limit (PLL) for each group of tendons for the period of extended operation.

4.5.2.1.2 10 CFR 54.21(c)(1)(ii)

An applicant may utilize this option as follows:

The predicted lower limits (PLLs) of prestressing forces for each group of tendons developed for 40 years period of operation should be extended to 60 years. The applicant should demonstrate that the trend lines of the measured prestressing forces will stay above the PLLs and the minimum required prestressing force value (MRV) in the CLB for each group of tendons during the period of extended operation (Ref. 4). If this cannot be done, the applicant should develop a systematic plan for retensioning selected tendons so that the trend lines will remain above the PLLs for each group of tendons during the period of extended operation, or perform a reanalysis of containment to demonstrate design adequacy.

4.5.2.1.3 10 CFR 54.21(c)(1)(iii)

In this option, an applicant should develop an aging managing program incorporating the ten elements: (1) scope of program, (2) preventive actions, (3) parameters monitored and inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience as described in the Branch Technical Position XX of this standard review plan, and address the following attributes:

(a) The tendon prestressing forces are monitored in accordance with ASME Section XI, Subsection IWL (Ref. 5), examination category L-B, "Unbonded Post-Tension System" and 10 CFR 50.55a(b)(2)(ix)(B) (Ref. 6);

(b) The trend lines of the measured prestressing forces should be developed for the period of extended operation. The applicant should demonstrate that the trend lines stay above the predicted lower limit (PLL) prestressing forces for each group of tendons during the period of extended operation;

(c) If the trend lines cross the PLLs at any time, corrective actions should be taken which include either systematic retensioning to ensure the adequacy of tendon forces or a reanalysis of containment to demonstrate design adequacy;

(d) The program should incorporate any plant operating experience, as well as operating experience at other plants as applicable to tendon force monitoring.

4.5.2.2 FSAR Supplement

The specific criterion for meeting 10 CFR 54.21(d) is:

The description of the time-limited aging analyses for the period of extended operation in the FSAR supplement should provide appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the time-limited aging analysis and the basis for determining that aging and time-dependent effects are managed during the period of extended operation.

4.5.3 Review Procedures

For each area of review described in Subsection 4.5.1 of this review plan section, the following

review procedures are followed:

4.5.3.1 Time-Limited Aging Analysis

For a prestressing tendon system that has been evaluated and determined to be acceptable for continued service to the end of the current operating term, the review procedures, depending on the applicant's choice, i.e., 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.5.3.1.1 10 CFR 54.21(c)(1)(i)

The results of a recent inspection to measure the amount of prestress loss are reviewed to ensure that the reduction of prestressing force is less than the predicted losses in the existing analysis. The reviewer verifies that the trend line of the measured prestressing force when plotted on the predicted prestressing force curve shows that the existing analysis will cover the period of extended operation.

4.5.3.1.2 10 CFR 54.21(c)(1)(ii)

The reviewer reviews the trend lines of the measured prestressing forces to ensure that individual tendon lift-off forces (rather than average lift-off forces of the tendon group) are considered in the regression analysis as discussed in IN 99-10 (Ref. 3). The reviewer verifies that the trend lines will stay above the predicted lower limit (PLL) prestressing forces for each group of tendons during the period of extended operation. If the trend lines fall below the PLL during the period of extended operation, the reviewer verifies that the applicant has a systematic plan for retensioning the tendons to ensure that the trend lines will remain above the PLL for each group of tendons during the period of extended operation. If the applicant chooses to reanalyze the containment, the reviewer verifies that the design adequacy is maintained in the period of extended operation.

4.5.3.1.3 10 CFR 54.21(c)(1)(iii)

The reviewer verifies that the aging managing program developed by the applicant addresses attributes (a) to (d) listed in Subsection 4.5.2.1.3 of this review plan section.

4.5.3.2 FSAR Supplement

The reviewer verifies that the applicant has provided a FSAR supplement on the description of the evaluation of the tendon prestress TLAA. Table 4.5-1 of this review plan section contains examples of acceptable FSAR supplement information for this TLAA. The reviewer verifies that the applicant has provided a FSAR supplement using a format similar to that in Table 4.5-1.

4.5.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and that the staff's evaluation supports conclusions of the following type, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has provided an acceptable demonstration or an aging management program, pursuant to 10 CFR 54.21(c)(1), that for the concrete

containment tendon prestress TLAA, (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate description of the concrete containment tendon prestress TLAA evaluation for the period of extended operation.

4.5.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

4.5.6 References

1. Regulatory Guide 1.35, Rev. 3, "Inspection of Ungrouted Tendons in Prestressed Concrete Containments," July 1990.

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

3. NRC Information Notice 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," April 1999.

4. NUREG/CR-XX, "Generic Aging Lessons Learned (GALL)," XXXX.

5. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for In-Service Inspection of Nuclear Power Plant Components," American Society of Mechanical Engineers, 1989; including Appendix VII, "Qualification of Nondestructive Examination Personnel for Ultrasonic Examination," and Appendix VIII (1989 Addenda), "Performance Demonstration for Ultrasonic Examination Systems," Subsection IWE (1992 Edition with 1992 Addenda), "Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Plants," and Subsection IWL (1992 Edition with 1992 Addenda), "Requirements for Class CC Concrete Components of Light-Water Cooled Plants."

6. Codes of Federal Regulations: 10 CFR 50.55a, "Codes and Standards."

Table 4.5-1. Examples of FSAR Supplement for Concrete Containment Tendon Prestress TLAA Evaluation

10 CFR 54.21(c)(1)(i) Example

TLAA	Description of Evaluation	Implementation Schedule
Concrete Containment Tendon Prestress	The prestressing tendons are used to impart compressive forces in the prestressed concrete containments to resist the internal pressure inside the containment that would be generated in the event of a LOCA. The prestressing forces generated by the tendons diminish over time due to losses in prestressing force in the tendons and the surrounding concrete. The prestressing force evaluation has been determined to remain valid to the end of the period of extended operation, and the trend lines of the measured prestressing forces will stay above the predicted lower limits for each group of tendons to the end of the period of extended operation.	Completed

10 CFR 54.21(c)(1)(ii) Example

TLAA	Description of Evaluation	Implementation Schedule
Concrete Containment Tendon Prestress	The prestressing tendons are used to impart compressive forces in the prestressed concrete containments to resist the internal pressure inside the containment that would be generated in the event of a LOCA. The prestressing forces generated by the tendons diminish over time due to losses in prestressing force in the tendons and the surrounding concrete. The prestressing forces have been re-evaluated and that the trend lines of the measured prestressing forces will stay above the predicted lower limits for each group of tendons to the end of the period of extended operation.	Completed

10 CFR 54.21(c)(1)(iii) Example

TLAA	Description of Evaluation	Implementation Schedule
Concrete Containment Tendon Prestress	The prestressing tendons are used to impart compressive forces in the prestressed concrete containments to resist the internal pressure inside the containment that would be generated in the event of a LOCA. The prestressing forces generated by the tendons diminish over time due to losses of	Program will be implemented by...

	prestressing force in the tendons and the surrounding concrete. The aging management program developed to monitor the prestressing force should ensure that, during each inspection, the trend lines of the measured prestressing forces show that they meet the requirements of 10 CFR 50.55a(b)(2)(ix)(B). If the trend lines cross the predicted lower limits corrective actions will be taken. The program will also incorporate any plant-specific and industry operating experience.	

4.6 CONTAINMENT LINER PLATE AND PENETRATIONS FATIGUE ANALYSIS

Review Responsibilities

Primary - Branch responsible for structural engineering
Secondary - Branch responsible for mechanical engineering

4.6.1 Areas of Review

The interior surface of a concrete containment structure is lined with thin metallic plates to provide a leak tight barrier against the uncontrolled release of radioactivity to the environment as required by 10 CFR Part 50. The thickness of the liner plates is generally between 6.2 mm (1/4 in) and 9.5 mm (3/8 in). The liner plates are attached to the concrete containment wall by means of stud anchors or structural rolled shapes or both. The design process assumes that the liner plates do not carry loads. However, normal loads, such as from concrete shrinkage, creep and thermal changes, imposed on the concrete containment structure are transferred to the liner plates through the anchorage system. Internal pressure and temperature loads are directly applied to the liner plates. Thus, under design-base conditions, the liner plates could experience significant strains. Fatigue of the liner plates is considered in the design based on an assumed number of loading cycles for the current operating term. The cyclic loads include reactor building interior temperature varying during the heatup and cooldown of the reactor coolant system, loss-of-coolant accident, annual outdoor temperature variations, thermal loads due to the high energy containment penetration piping lines, such as steam and feedwater lines, seismic loads, and pressurization due to periodic Type A integrated leak rate tests.

High energy piping penetrations and fuel transfer canal in some plants are equipped with bellow assemblies. These are designed to accommodate relative movements between the containment wall (including the liner) and the adjoining structures. The penetrations have sleeves (up to 10 feet in length, with a 2 to 3-inch annulus around the piping) to penetrate the concrete containment wall and allow movement of the piping system. Dissimilar metal welds connect the piping penetrations to the bellows to provide leaktight penetrations. The containment liner plates, penetration sleeves (including dissimilar metal welds), and penetration bellows are Class 1 components. They are generally designed in accordance with requirements of ASME Section III which requires a fatigue analysis based on an assumed number of load cycles. This fatigue analysis is a Time-Limited Aging Analysis (TLAA) and must be evaluated in accordance with 10 CFR 54.21(c)(1) to ensure that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The adequacy of the fatigue analyses of the containment liner plates (including welded joints), penetration sleeves, dissimilar metal welds, and penetration bellows is reviewed in this review plan section for the period of extended operation. The fatigue analyses of the high energy containment penetration piping lines are reviewed separately following the guidance in Section 4.3, "Metal Fatigue" of this standard review plan.

4.6.1.1 Time-Limited Aging Analysis

The containment liner plates (including welded joints), penetration sleeves, dissimilar metal welds, and penetration bellows are generally designed and/or analyzed in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code requirements. The ASME code contains explicit metal fatigue or cyclic considerations based on time-limited aging analyses.

4.6.1.1.1 ASME Section III, Class 1

ASME Class II, III, or MC components, such as containment liner plates, penetration sleeves, dissimilar metal welds, and penetration bellows, are analyzed for metal fatigue. ASME Section III, Division 2, "Code for Concrete Reactor Vessel and Containments, Subsection CC, Concrete Containment" (Ref. 1) requires a fatigue analysis for liner plates considering all cyclic loads, and is based on the anticipated number of cycles. A Section III Class 1 fatigue analysis requires the calculation of the "cumulative usage factor" (CUF) based on the fatigue properties of the materials and the expected fatigue service of the component. The ASME Code limits the CUF to a value of less than unity for acceptable fatigue design. The fatigue resistance of the liner plate, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows during the period of extended operation is an area of review.

4.6.1.1.2 Other Evaluations Based on CUF

Other evaluations also contain metal fatigue analysis requirements based on a CUF calculation such as metal bellows designed to ASME NC-3649.4(e)(3), ND-3649.4(e)(3), or NE-3366.2(e)(3). For these cases, the discussion relating to ASME Section III, Class 1 in Subsection 4.6.1.1.1 of this review plan section applies.

4.6.1.2 FSAR Supplement

Detailed information on the evaluation of time-limited aging analyses is contained in the renewal application. A summary description of the evaluation of time-limited aging analyses for the period of extended operation is contained in the applicant's final safety analysis report (FSAR) supplement. The FSAR supplement is an area of review.

4.6.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Subsection 4.6.1 of this review plan section define acceptable methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(c)(1).

4.6.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1), an applicant must demonstrate one of the following:

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the extended period of operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Specific acceptance criteria for fatigue of containment liner plates, liner plate weld joints, dissimilar metal welds, penetration sleeves, and penetration bellows are:

4.6.2.1.1 ASME Section III, Class 1

For containment liner plates, liner plate weld joints, penetration sleeves, dissimilar metal welds,

and penetration bellows designed or analyzed to ASME Class 1 requirements, the acceptance criteria, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.6.2.1.1.1 10 CFR 54.21(c)(1)(i)

The existing CUF calculations remain valid because the number of assumed cyclic loads during the period of extended operation would not exceed the ones considered for the current licensing basis.

4.6.2.1.1.2 10 CFR 54.21(c)(1)(ii)

Current license basis fatigue analysis, per ASME Code, Section III, were conducted for a 40 years life. The CUF calculations should be re-evaluated based on an increased number of assumed cyclic loads to include the period of extended operation. All cyclic loads considered in the original fatigue analyses (including Type A and Type B leak rate tests) should be reevaluated and revised as necessary (Ref. 2). The revised analysis should show that the CUF will not exceed unity as required by the ASME code during the period of extended operation.

4.6.2.1.1.3 10 CFR 54.21(c)(1)(iii)

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The component could be replaced and the CUF for the replacement will be less than unity during the period of extended operation.

Alternative aging management program provided by the applicant will be evaluated on a case-by-case basis to ensure that the aging effects will be managed such that the intended functions(s) will be maintained during the period of extended operation. The aging management program will be evaluated against the ten elements described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

4.6.2.1.2 Other Evaluations Based on CUF

The acceptance criteria in Subsection 4.6.2.1.1 of this review plan section apply.

4.6.2.2 FSAR Supplement

The specific criterion for meeting 10 CFR 54.21(d) is:

The summary description of the evaluation of time-limited aging analyses for the period of extended operation in the FSAR supplement provides appropriate description such that later changes can be controlled by 10 CFR 50.59 or 10 CFR 50.90. The description should contain information associated with the time-limited aging analysis regarding the basis for determining that aging effects are managed during the period of extended operation.

4.6.3 Review Procedures

For each area of review described in Subsection 4.6.1 of this review plan section, the following review procedures are followed:

4.6.3.1 Time-Limited Aging Analysis

4.6.3.1.1 ASME Section III, Class 1

For containment liner plates, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows, designed or analyzed to ASME Class 1 requirements, the review procedures, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.6.3.1.1.1 10 CFR 54.2l(c)(1)(i)

A list of the assumed cyclic loads used in the existing CUF calculations for the current operating term and operating transient experience is reviewed to ensure that the number of cyclic loads assumed in the current licensing basis would not be exceeded during the period of extended operation.

4.6.3.1.1.2 10 CFR 54.21(c)(1)(ii)

A list of the increased number of assumed cyclic loads projected to the end of the period of extended operation and operating transient experience is reviewed to ensure that the cyclic load projection is adequate. The basis of the determination of the maximum expected load cycles for 60 years operation is reviewed. The revised CUF calculations based on the projected number of assumed cyclic loads are reviewed to ensure that the CUF remains less than unity at the end of the period of extended operation.

The code of record should be used for the re-evaluation, or the applicant may update to a later code edition pursuant to 10 CFR 50.55a. In the latter case, the reviewer verifies that the requirements in 10 CFR 50.55a are met.

4.6.3.1.1.3 10 CFR 54.2l(c)(1)(iii)

The applicant's proposed aging management program to ensure that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation is reviewed. If the applicant proposed component replacement before its CUF exceeds unity, the reviewer verifies that the CUF for the replacement will remain less than unity during the period of extended operation.

Other applicant proposed programs will be reviewed on a case-by-case basis.

4.6.3.1.2 Other Evaluations Based on CUF

The review procedures in Subsection 4.6.3.1 of this review plan section apply.

4.6.3.2 FSAR Supplement

The reviewer verifies that the applicant has provided a FSAR supplement on the summary description of the evaluation of the containment liner plate and penetrations fatigue TLAA. Table 4.6-1 of this review plan section contains examples of acceptable FSAR supplement information for this TLAA. The reviewer verifies that the applicant has provided a FSAR supplement using a format similar to that in Table 4.6-1.

4.6.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this standard review plan section and that the staff's evaluation supports conclusions of the following type, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that for the containment liner plate and penetrations fatigue TLAA, (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the containment liner plate and penetrations fatigue TLAA evaluation for the period of extended operation.

4.6.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

4.5.6 References

1. ASME Boiler and Pressure Vessel Code, Section III, Division 2, "Code for Concrete Reactor Vessels and Containments, Subsection CC, Concrete Containment," American Society of Mechanical Engineers, New York, New York, 1989 Edition.

2. NUREG-XXXX, "Generic Aging Lessons Learned (GALL)," XXXX.

Table 4.6-1. Examples of FSAR Supplement for Containment Liner Plate and Penetrations Fatigue TLAA Evaluation

10 CFR 54.21(c)(1)(i) Example

TLAA	Description of Evaluation	Implementation Schedule
Containment liner plate and penetrations fatigue	The containment liner plates, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows provide a leak tight barrier. A Section III Class 1 fatigue analysis limits the "Cumulative Usage Factor" (CUF) to a value of less than unity for acceptable fatigue design. The existing CUF evaluation has been determined to remain valid because the number of assumed cyclic loads would not be exceeded during the period of extended operation.	Completed

10 CFR 54.21(c)(1)(ii) Example

TLAA	Description of Evaluation	Implementation Schedule
Containment liner plate and penetrations fatigue	The containment liner plates, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows provide a leak tight barrier. A Section III Class 1 fatigue analysis limits the CUF to a value of less than unity for acceptable fatigue design. The CUF calculations have been re-evaluated based on an increased number of assumed cyclic loads to include the period of extended operation and the revised CUF will not exceed unity during the period of extended operation.	Completed

10 CFR 54.21(c)(1)(iii) Example

TLAA	Description of Evaluation	Implementation Schedule
Containment liner plate and penetrations fatigue	The containment liner plates, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows provide a leak tight barrier. A Section III Class 1 fatigue analysis limits the CUF to a value of less than unity for acceptable fatigue design. The component will be replaced and the CUF for the replacement will be shown to be less than unity during the period of extended operation.	Program will be implemented by...

Note: All containment components need not meet the same requirement. It is likely that the liner plate and the bellows may be evaluated per 10CFR54.21(c)(1)(i), while high energy penetrations may be evaluated per 10CFR54.21(c)(1)(ii).

4.8 OTHER PLANT-SPECIFIC TIME LIMITED AGING ANALESES

Review Responsibilities

Primary - Branch responsible for engineering
Secondary – Other branches responsible for systems, as appropriate

4.8.1 Areas of Review

There are certain plant-specific safety analyses which may have been based on an explicitly assumed 40-year plant life (for example, aspects of the reactor vessel design). Pursuant to 10 CFR 54.21(c), a license renewal applicant is required to evaluate time-limited aging analyses (TLAAs). The definition of TLAAs is provided in 10 CFR 54.3 and Section 4.1of this standard review plan.

TLAA requirements may have evolved and are plant-specific. The adequacy of the plant's current licensing basis (CLB), which includes TLAAs, is not an area of review. Potential concerns or enhancements regarding the CLB are to be addressed under the backfit rule (10 CFR 50.109) and are separate from the license renewal process.

License renewal reviews focus on the period of extended operation. Pursuant to 10 CFR 54.30, if the reviews show that the TLAAs are not sufficient to provide reasonable assurance during the current license term that licensed activities will be conducted in accordance with the CLB, the licensee is required to take measures under its current license to ensure that the intended function of those structures or components will be maintained in accordance with the CLB throughout the term of the current license. The adequacy of the measures for the term of the current license is not an area of review for license renewal.

Pursuant to 10 CFR 54.21(c), an applicant must provide a listing of TLAAs and plant-specific exemptions that are based on TLAAs. The staff reviews the applicant's identification of TLAAs and exemptions that are based on TLAAs separately following the guidance in Section 4.1 of this standard review plan.

Based on lessons learned in the review of the initial license renewal applications, the staff has developed review procedures for the evaluation of certain TLAAs. If an applicant identifies these TLAAs as applicable to its plant, the staff reviews them separately following the guidance in Sections 4.2 through 4.7 of this standard review plan. The staff reviews other TLAAs that are identified by the applicant following the generic guidance in this review plan section. The staff from branches responsible for systems may be requested to assist in the review, as appropriate.

The following areas relating to a TLAA are reviewed:

4.8.1.1 Time-Limited Aging Analysis

The evaluation of the TLAA for the period of extended operation is reviewed.

4.8.1.2 FSAR Supplement

The FSAR supplement summarizing the evaluation of the TLAA for the period of extended operation in accordance with 10 CFR 54.21(d) is reviewed.

4.8.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Subsection 4.8.1 of this review plan section define acceptable methods for meeting the requirements of the Commission's regulations in 10 CFR 54.21(c)(1).

4.8.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1)(i) through (iii), an applicant must demonstrate one of the following for the TLAAs:

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the extended period of operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.8.4.2.2 FSAR Supplement

The specific criterion for meeting 10 CFR 54.21(d) is:

The summary description of the evaluation of TLAAs for the period of extended operation in the FSAR supplement provides appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the TLAAs regarding the basis for determining that aging effects are managed in the period of extended operation.

4.8.3 Review Procedures

The requirement of TLAAs captures, for renewal review, certain plant-specific aging analyses that are explicitly based on the duration of the current operating license of the plant. The concern is that these aging analyses do not cover the period of extended operation. Unless these analyses are evaluated, there is no assurance that the systems, structures, and components addressed by these analyses can perform their intended function(s) during the period of extended operation.

For each area of review described in Subsection 4.8.1 of this review plan section, the following review procedures are followed:

4.8.3.1 Time-Limited Aging Analysis

For the TLAA identified, the review procedures depending on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:

4.8.3.1.1 10 CFR 54.21(c)(1)(i)

Justification provided by the applicant is reviewed to verify that the existing analyses are valid for the period of extended operation. The existing analyses should be shown to be bounding even during the period of extended operation.

An applicant should describe the TLAA with respect to the objectives of the analysis, conditions, and assumptions used in the analysis, acceptance criteria, relevant aging effects, and intended function(s). The applicant should show that (1) the conditions and assumptions used in the analysis already address the relevant aging effects for the period of extended operation, and (2) acceptance criteria are maintained to provide reasonable assurance that the intended function(s) is maintained for renewal. Thus, no reanalysis is necessary for renewal.

If the TLAA has to be modified or recalculated to extend the period of evaluation to cover the period of extended operation, the re-evaluation should be addressed under 10 CFR 54.21(c)(1)(ii).

4.8.3.1.2 10 CFR 54.21(c)(1)(ii)

The revised analyses are reviewed to verify that the period of evaluation of the analyses is extended such that they are valid for the period of extended operation, for example, 60 years. The applicable analysis technique can be the one that is in effect in the plant's CLB at the time of renewal application.

An applicant may recalculate the TLAA using a 60 year period to show that the TLAA acceptance criteria continue to be satisfied for the period of extended operation. The applicant may also revise the TLAA by recognizing and re-evaluating any overly conservative conditions and assumptions. Examples include relaxing overly conservative assumptions in the original analysis, using new or refined analytical techniques, and performing the analysis using a 60 year period.

As applicable, the plant's code of record should be used for the re-evaluation or the applicant may update to a later code edition pursuant to 10 CFR 50.55a. In the latter case, the reviewer verifies that the requirements in 10 CFR 50.55a are met.

4.8.3.1.3 10 CFR 54.21(c)(1)(iii)

Under this option, an applicant would propose to manage the aging effects associated with the TLAA by an aging management program, in the same manner as the integrated plant assessment (IPA) in 10 CFR 54.21(a)(3). The reviewer reviews the applicant's aging management program to verify that the effects of aging on the intended function(s) will be adequately managed consistent with the CLB for the period of extended operation.

An applicant should identify the structures and components associated with the TLAA. The TLAA should be described with respect to the objectives of the analysis, conditions, and assumptions used in the analysis, acceptance criteria, relevant aging effects and intended function(s). The reviewer may use the guidance provided in Branch Technical Position RLSB-1 of this standard review plan to ensure that the effects of aging on the structure and component intended function(s) are adequately managed for the period of extended operation.

4.8.3.2 FSAR Supplement

The reviewer verifies that the applicant has provided a FSAR supplement on the description of the evaluation of the TLAA. The summary description of the evaluation of TLAA for the period of extended operation in the FSAR supplement is reviewed to verify that it provides an appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the TLAA regarding the basis for

determining that aging effects are managed in the period of extended operation. Sections 4.2 through 4.7 of this standard review plan contains examples of acceptable FSAR supplement information for TLAA evaluation.

4.8.4 Evaluation Findings

The reviewer verifies that sufficient and adequate information has been provided to satisfy the provisions of this review plan section and that the staff's evaluation supports conclusions of the following type, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), to be included in the staff's safety evaluation report:

> The staff evaluation concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the (name of specific) TLAA, (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of this TLAA evaluation for the period of extended operation.

4.8.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein will be used by the staff in its evaluation of conformance with Commission regulation.

4.8.6 References

None.

A.1 AGING MANAGEMENT REVIEW - GENERIC (BRANCH TECHNICAL POSITION RLSB-1)

A.1.1 Background

Pursuant to 10 CFR 54.21(a)(3), a license renewal applicant is required to demonstrate that the effects of aging on structures and components subject to an aging management review will be adequately managed so that their intended functions will be maintained consistent with the current licensing basis (CLB) for the period of extended operation. The purpose of this branch technical position is to address the aging management demonstration that has not been addressed specifically in Chapters 3 and 4 of this standard review plan.

The license renewal process is not intended to demonstrate absolute assurance that structures and components will not fail, but rather that there is reasonable assurance that they will perform such that the intended functions are maintained consistent with the CLB during the period of extended operation.

Aging management programs are generally of four types: prevention, mitigation, condition monitoring, and performance monitoring. Prevention programs preclude the effects of aging from occurring, for example, coating programs to prevent external corrosion of a tank. Mitigation programs attempt to slow the effects of aging, for example, water chemistry programs to mitigate internal corrosion of piping. Condition monitoring programs inspect and examine for the presence and extent of aging effects, for example, visual inspection of concrete structures for cracking and ultrasonic measurement of pipe wall for erosion-corrosion induced wall thinning. Performance monitoring programs test the ability of a structure or component to perform its intended function(s), for example, heat balances on heat exchangers for the heat transfer intended function of the tubes. In many instances, more than one type of aging management programs are implemented to ensure that aging effects are managed. For example, in managing internal corrosion of piping, a mitigation program (water chemistry) may be used to minimize susceptibility to corrosion. However, it may also be necessary to have a condition monitoring program (ultrasonic inspection) to verify that corrosion is indeed insignificant.

A.1.2 Branch Technical Position

A.1.2.1 Applicable Aging Effects

1. The determination of applicable aging effects is based on the degradations that have actually occurred and those that potentially could cause structure and component degradation. The materials, environment, stresses, service conditions, operating experience, and other relevant information should be considered in identifying applicable aging effects. The effects of aging on the structure and component intended function(s) should also be considered.

2. Relevant aging information may be contained in, but not limited to, the following documents: plant-specific maintenance and inspection records; plant-specific site deviation or issue reports; plant-specific NRC and Institute of Nuclear Power Operations (INPO) inspection reports; plant-specific licensee self-assessment reports; plant-specific and other licensee event reports (LERs); NRC, INPO, and vendor generic communications; generic safety issues/unresolved safety issues (GSIs/USIs); NUREG reports; and Electric Power Research Institute (EPRI) reports.

3. If operating experience or other information indicates that a certain aging effect may be potentially applicable and an applicant determines that it is not applicable to its plant, the basis for this determination should be provided.

4. An aging effect should be identified as applicable for license renewal even if there is a preventative or mitigation program associated with that aging effect. For example, water chemistry, a coating, or use of cathodic protection could prevent or mitigate corrosion, but corrosion should be identified as applicable for license renewal and the aging management review should consider the adequacy of the water chemistry, coating, or cathodic protection.

5. Specific identification of aging mechanisms is not a requirement; however, it is an option to identify specific aging mechanisms and the associated aging effects in the integrated plant assessment (IPA).

6. The applicable aging effects to be considered for license renewal include those that could result from normal plant operation, including plant/system operating transients and plant shutdown. Aging effects from abnormal events need not be postulated specifically for license renewal. However, if an abnormal event has occurred at a particular plant, its contribution to the aging effects on structures and components for license renewal should be considered for that plant. For example, if a resin intrusion has occurred in the reactor coolant system at a particular plant, the contribution of this resin intrusion event to aging should be considered for that plant.

   Design basis events (DBEs) are abnormal events and they include: design basis pipe break, loss of coolant accident (LOCA), and safe shutdown earthquake (SSE). Potential degradations resulting from DBEs are addressed, as appropriate, as part of the plant's CLB. There are other abnormal events which should be considered on a case-by-case basis. For example, abuse due to human activity is an abnormal event and aging effects from such abuse need not be postulated for license renewal. When a safety significant piece of equipment is accidentally damaged by a licensee, the licensee is required to take immediate corrective action under existing procedures, that is, Appendix B to 10 CFR Part 50, to ensure functionality of the equipment. The equipment degradation is not due to aging and corrective action is not necessary solely for the period of extended operation. However, for example, leakage from bolted connections should not be considered as abnormal events. Although bolted connections are not supposed to leak, experience shows that leaks do occur and the leakage could cause corrosion. Thus, the aging effects from leakage of bolting connections should be evaluated for license renewal.

   In addition, an aging effect observed as a result of an abnormal event does not necessarily preclude that aging effect from occurring during normal operation for the period of extended operation. For example, a certain pressurized water reactor observed clad cracking in its pressurizer and attributed that to an abnormal dry out of the pressurizer. Although dry out of a pressurizer is an abnormal event, the potential for clad cracking in the pressurizer during normal operation should still be evaluated for license renewal. This is because the pressurizer is subject to extensive thermal fluctuations and water level changes during plant operation which may result in clad cracking given sufficient operating time. The abnormal dry out of the pressurizer at that certain plant may have merely accelerated the rate of the aging effect.

A.1.2.2 Aging Management for License Renewal

1. An acceptable aging management program should consist of the 10 elements described in Table A.1-1, as appropriate (Ref. 1). These program elements/attributes are discussed further in Position A.1.2.3 below.

2. All programs and activities that are credited for managing a certain aging effect for a specific structure or component should be described. These aging management programs/activities may be evaluated together for the 10 elements described in Table A.1-1, as appropriate.

3. The risk significance of a structure or component could be considered in evaluating the robustness of an aging management program. Probabilistic arguments may be used to assist in developing an approach for aging management adequacy. However, use of probabilistic arguments alone is not an acceptable basis for concluding that, for those structures and components subject to an aging management review, the effects of aging will be adequately managed in the period of extended operation. Thus, risk significance may be considered in developing the details of an aging management program for the structure or component for license renewal, but may not be used to conclude that no aging management program is necessary for license renewal.

A.1.2.3 Aging Management Program Elements

A.1.2.3.1 Scope of Program

1. The specific program necessary for license renewal should be identified. The scope of the program should include the specific structures and components that the program is credited for managing aging of.

A.1.2.3.2 Preventive Actions

1. For prevention and mitigation programs, the activities for prevention and mitigation should be described. These actions should mitigate or prevent aging degradation.

2. For condition or performance monitoring programs, they do not rely on preventive actions and thus, this information need not be provided. However, in many instances, more than one type of aging management programs should be implemented to ensure that aging effects are managed.

A.1.2.3.3 Parameters Monitored or Inspected

1. The parameters to be monitored or inspected should be identified. These parameters should be linked to the degradation of the particular structure and component intended function(s).

2. For a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects. Some examples are measurements of wall thicknesses and detection and sizing of cracks.

3. For a performance monitoring program, a link should be established between the degradation of the particular structure and component intended functions and the parameter(s) being monitored. An example where a performance monitoring program could

link the degradation of passive component intended function(s) with the performance being monitored is heat balances on heat exchangers to ensure the heat transfer intended function of the tubes. Fouling of the heat exchanger tubes affects the heat transfer intended function and could be monitored by periodic heat balances. While this example only deals with one intended function of the tubes, which is heat transfer, additional programs may be necessary to manage other intended function(s) of the tubes, such as pressure boundary.

A performance monitoring program may not assure the structure and component intended function(s) without linking the degradation of passive intended functions with the performance being monitored. For example, a periodic diesel generator test alone would not provide assurance that the diesel will start and run properly under all applicable design conditions. While the test verifies that the diesel will perform if all the support systems function, it provides little information related to the material condition of the support components and their ability to withstand design basis event loads. Thus, a design basis event, such as a seismic event, could cause the diesel supports, such as the diesel embedment plate anchors or the fuel oil tank, to fail if the effects of aging on these components are not managed during the period of extended operation.

4. For prevention and mitigation programs, the parameters monitored should be the specific parameters being controlled to achieve prevention or mitigation of aging effects. An example is the coolant oxygen level which is being controlled in a water chemistry program to mitigate pipe cracking.

A.1.2.3.4 Detection of Aging Effects

1. Detection of aging effects should occur before there is a loss of the structure and component intended function(s). The parameters to be monitored or inspected should be appropriate to ensure that the structure and component intended function(s) will be adequately maintained for license renewal under all CLB design conditions.

2. Nuclear power plants are licensed based on redundancy, diversity, and defense-in-depth principles. A degraded or failed component reduces the reliability of the system, challenges safety systems, and contributes to plant risk. Thus, the effects of aging on a structure or component should be managed to ensure its availability to perform its intended function(s) as designed when called upon. In this way, all system level intended function(s), including redundancy, diversity, and defense-in-depth consistent with the plant's CLB, would be maintained for license renewal. A program based solely on detecting structure and component failure should not be considered as an effective aging management program for license renewal.

A.1.2.3.5 Monitoring and Trending

1. Monitoring and trending activities should be described and they should provide predictability of the extent of degradation and timely corrective or mitigative actions. Monitoring, inspection, technique, frequency, and sample size should be appropriate for timely detection of aging effects. Plant-specific and/or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency.

2. Sampling may be used to inspect a group of structures and components. There should be a basis for selecting the inspection population and sample size. The population should be selected based on similarity of materials of construction, fabrication, procurement, design,

installation, operating environments, and aging effects. The sample size should be selected based on consideration of the specific aging effect, location, existing technical information, system and structure design, materials of construction, service environment, previous failure history, etc. The samples should be biased towards locations most susceptible to the specific aging effect of concern. Provisions should also be included on expanding the sample size when degradation is detected in the initial sample.

A.1.2.3.6 Acceptance Criteria

1. The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation. The program should include a methodology for analyzing the results against applicable acceptance criteria.

   For example, carbon steel pipe wall thinning may occur under certain conditions due to erosion-corrosion. An aging management program for erosion-corrosion may consist of periodically measuring the pipe wall thickness and comparing that to a specific minimum wall acceptance criterion. Corrective action is taken, such as piping replacement, prior to reaching this acceptance criterion. This piping may be designed for thermal, pressure, deadweight, seismic, and other loads, and this acceptance criterion must be appropriate to ensure that the thinned piping would be able to carry these CLB design loads. This acceptance criterion should provide for timely corrective action before loss of intended function under these CLB design loads.

2. Acceptance criteria could be numerical values. Or, it could be a discussion of the process for calculating the specific numerical values of the acceptance criteria to ensure that the structure and component intended function(s) will be maintained under all CLB design conditions. If references are available, this information may be referenced.

3. It is not necessary to justify any acceptance criteria taken directly from the design basis information that is included in the FSAR because that is a part of the CLB. Also, it is not necessary to discuss CLB design loads if the acceptance criteria do not permit degradation because a structure and component without degradation should continue to function as originally designed.

A.1.2.3.7 Corrective Actions

1. Actions to be taken when the acceptance criteria are not met should be described. Corrective actions, including root cause determination and prevention of recurrence, should be timely.

2. If corrective actions permit analysis without repair or replacement, the analysis should ensure that the structure and component intended function(s) will be maintained consistent with the CLB.

A.1.2.3.8 Confirmation Process

1. The confirmation process should be described. The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

2. For prevention and mitigation programs, the effectiveness of these programs should be periodically verified. For example, in managing internal corrosion of piping, a mitigation program (water chemistry) may be used to minimize susceptibility to corrosion. However, it may also be necessary to have a condition monitoring program (ultrasonic inspection) to verify that corrosion is indeed insignificant.

3. When corrective actions are necessary, there should be follow up activities to confirm that the corrective actions are completed, root cause determination is performed, and recurrence is prevented.

A.1.2.3.9 Administrative Controls

1. The administrative controls of the program should be described. The administrative controls should provide a formal review and approval process.

2. Any aging management programs to be relied on for license renewal should have regulatory and administrative controls. That is the basis for 10 CFR 54.21(d) to require that the FSAR supplement includes a summary description of the programs and activities for managing the effects of aging for license renewal. Thus, any informal programs relied on to manage aging for license renewal need to be administratively controlled and included in the FSAR supplement.

A.1.2.3.10 Operating experience

1. Operating experience with existing programs should be discussed. The operating experience of aging management programs, including past corrective actions resulting in program enhancements or additional programs, should be reviewed. A past failure would not necessarily invalidate an aging management program because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information can show where an existing program has succeeded and where it has failed, if any, in intercepting aging degradation in a timely manner. This information should provide objective evidence to support that the effects of aging will be adequately managed so that the structure and component intended function(s) will be maintained during the period of extended operation.

2. An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

A.1.3 References

1. NEI 95-10, Revision 1, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Nuclear Energy Institute, January 2000.

Table A.1-1. Elements of an Aging Management Program for License Renewal

Element	Description
1. Scope of program	Scope of program should include the specific structures and components subject to an aging management review for license renewal.
2. Preventive actions	Preventive actions should mitigate or prevent aging degradation.
3. Parameters monitored or inspected	Parameters monitored or inspected should be linked to the degradation of the particular structure and component intended function(s).
4. Detection of aging effects	Detection of aging effects should occur before there is a loss of the structure and component intended function(s).
5. Monitoring and trending	Monitoring and trending should provide predictability of the extent of degradation and timely corrective or mitigative actions. The monitoring, inspection, testing frequency, and sample size should be appropriate for timely detection of aging effects.
6. Acceptance criteria	Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation.
7. Corrective actions	Corrective actions, including root cause determination and prevention of recurrence, should be timely.
8. Confirmation process	Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.
9. Administrative controls	Administrative controls should provide a formal review and approval process.
10. Operating experience	Operating experience of the aging management program, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support that the effects of aging will be adequately managed so that the structure and component intended function(s) will be maintained during the period of extended operation.

A.2 QUALITY ASSURANCE FOR AGING MANAGEMENT PROGRAMS (BRANCH TECHNICAL POSITION IQMB-1)

A.2.1 Background

The license renewal applicant is required to demonstrate that the effects of aging on structures and components subject to an aging management review will be adequately managed to assure that their intended functions will be maintained consistent with the current licensing basis (CLB) of the facility for the period of extended operation. The applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls, as described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan. Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective. Administrative controls should provide a formal review and approval process. Reference 1 describes how a license renewal applicant can rely on the existing requirements in 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants" to satisfy these program elements/attributes. The purpose of this branch technical position is to describe an acceptable process for implementing the corrective actions, confirmation process, and administrative controls elements of aging management programs for license renewal.

A.2.2 Branch Technical Position

1. Safety-related structures and components are subject to 10 CFR Part 50, Appendix B requirements which are adequate to address the corrective actions, confirmation process, and administrative controls elements of an aging management program for license renewal. Therefore, 10 CFR Part 50, Appendix B, may be relied upon to satisfy these program elements for management of aging of safety-related structures and components during the period of extended operation.

2. For non-safety-related structures and components that are subject to an aging management program for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B program to include these structures and components to address corrective actions, confirmation process, and administrative controls for aging management during the period of extended operation. The applicant should document such a commitment in the final safety analysis report (FSAR) supplement in accordance with 10 CFR 54.21(d).

3. If an applicant chooses to have alternative means to address corrective actions, confirmation process, and administrative controls for managing aging of non-safety-related structures and components that are subject to an aging management program for license renewal, the applicant's proposal should be reviewed on a case-by-case basis following the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

A.2.3 References

1. NUREG-xxxx, "Generic Aging Lessons Learned (GALL), Appendix," U.S. Nuclear Regulatory Commission, XXXX.

A.3 GENERIC SAFETY ISSUES RELATED TO AGING (BRANCH TECHNICAL POSITION RLSB-2)

A.3.1 Background

Unresolved safety issues (USIs) and generic safety issues (GSIs) are identified and tracked in the NRC's formal generic safety issues resolution process set forth in NUREG-0933, "A Prioritization of Generic Safety Issues," which is updated periodically (Ref. 1). NUREG-0933 is a source of information on generic concerns identified by the NRC. Some of these generic concerns may be related to the effects of aging or time-limited aging analyses (TLAAs) as defined in 10 CFR 54.3. The purpose of this branch technical position is to address the license renewal treatment of an aging effect or a TLAA which is a subject of a USI or GSI (60 FR 22484).

Table A.3-1 provides examples on determining whether a GSI should/should not be specifically addressed for license renewal, based on lessons learned from the staff review of the initial license renewal applications. The examples were on issues designated as HIGH- priority issues in NUREG-0933 at the time. However, two of these (GSI-23 and -190) have been resolved during the staff review of the initial license renewal applications (Refs. 2 and 3). They are included in the examples for illustrative purposes.

A.3.2 Branch Technical Position

A.3.2.1 Treatment of GSIs

1. The license renewal rule requires that aging effects be managed to ensure that the structure and component intended function(s) are maintained and that TLAAs be evaluated for license renewal. Thus, all applicable aging effects of structures and components subject to an aging management review and all TLAAs must be evaluated, regardless of whether they are associated with GSIs or USIs.

2. USI, HIGH-, and MEDIUM- priority issues described in Appendix B in NUREG-0933 (Ref. 1), that involve aging effects for structures and components subject to an aging management review or TLAAs, should be specifically addressed. The version of NUREG-0933 that is current on the date 6 months before the date of the license renewal application should be used to identify such issues. One of the approaches described in Position A.3.2.2 below may be used to address them (60 FR 22484).

3. The amendment to the license renewal application identifying current licensing basis (CLB) changes, as required by 10 CFR 54.21(b), should address any additional USI, HIGH-, or MEDIUM- priority issues designated after the application has been submitted, that involve aging effects for structures and components subject to an aging management review or TLAAs.

4. During the preparation and review of a license renewal application, an applicant or the NRC may become aware of an aging management or TLAA issue that may be generically applicable to other nuclear plants. If issues may have generic applicability (but are not yet part of the formal generic safety issues resolution process as identified in NUREG-0933), an applicant should still address the issue to demonstrate that the effects of aging are or will be adequately managed or that TLAAs have been evaluated for the period of extended operation.

A.3.2.2 Approaches for Addressing GSIs

One of the following approaches may be used:

1. If resolution has been achieved before issuance of a renewed license, implementation of that resolution could be incorporated within the license renewal application. The plant-specific implementation information should be provided.

2. A technical rationale could be provided, which demonstrates that the CLB will be maintained until some later point in time in the period of extended operation, at which point one or more reasonable options (for example, replacement, analytical evaluation, or a surveillance/ maintenance program) would be available to adequately manage the effects of aging. An applicant would have to describe the basis for concluding that the CLB is maintained in the period of extended operation and briefly describe options that are technically feasible during the period of extended operation to manage the effects of aging, but it would not have to pre-select which option would be used.

3. An aging management program could be developed, which, for that plant, incorporates a resolution to the aging effects issue.

4. An amendment of the CLB (as a separate action outside the license renewal application) could be proposed, which, if approved, would remove the intended function(s) from the CLB. The proposed CLB amendment is reviewed under 10 CFR Part 50 and is not a review area for license renewal.

A.3.3 References

1. NUREG-0933, "A Prioritization of Generic Safety Issues," Supplement 23, April 1999.

2. NRC Regulatory Issue Summary 2000-02, "Closure of Generic Safety Issue 23, Reactor Coolant Pump Seal Failure," February 15, 2000.

3. Letter from Ashok C. Thadani of the Office of Nuclear Regulatory Research, NRC, to William D. Travers, Executive Director of Operations, NRC, dated December 26, 1999.

4. SECY 94-225, "Issuance of Proposed Rulemaking Package on GSI-23, Reactor Coolant Pump Seal Failure," August 26, 1994.

5. Information Notice 93-61, "Excessive Reactor Coolant Leakage Following a Seal Failure in a Reactor Coolant Pump or Reactor Recirculation Pump," August 9, 1993.

6. Letter to Doug Walters, Nuclear Energy Institute, from Christopher I Grimes, NRC, dated June 2, 1998.

Table A.3-1. Examples of Generic Safety Issues that Should/Should Not be Specifically Addressed for License Renewal and Basis for Disposition

Example	Disposition
GSI-23, "Reactor Coolant Pump Seal Failures"	This issue relates to reactor coolant pump seal failures, which challenge the makeup capacity of the emergency core cooling system in pressurized water reactors. Although GSI-23 originally addressed seal performance both during normal operation and during loss of seal cooling conditions, it has been modified to only address seal performance during loss of seal cooling conditions (Refs. 4 and 5). Loss of all seal cooling may cause the reactor coolant pump seals to fail or leak excessively. Because the reactor coolant pump seal performance during loss of seal cooling conditions is not an issue that involves aging management review or TLAA, GSI-23 needs not be specifically addressed for license renewal. (Ref. 2)
GSI-168, "Environmental Qualification of Electrical Equipment"	This issue relates to aging of electrical equipment that is subject to environmental qualification (EQ) requirements. EQ is a TLAA for license renewal. Thus, GSI-168 should be specifically addressed for license renewal. (Ref. 6)
GSI-173.A, "Spent Fuel Storage Pool: Operating Experience"	This issue relates to the potential for a sustained loss of spent fuel pool cooling capacity and the potential for a substantial loss of spent fuel pool coolant inventory. The staff evaluated the issue and concluded that no actions will be taken for operating plants. As indicated in NUREG-0933, the staff is pursuing regulatory improvement changes to Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," and NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants." Thus, GSI-173.A needs not be specifically addressed for license renewal.
GSI-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life"	This issue relates to environmental effects on fatigue of reactor coolant system components for 60 years. Fatigue is also a TLAA for license renewal. Thus, GSI-190 was specifically addressed for license renewal by the initial license renewal applicants. This GSI has now been resolved (Ref. 3).

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