NUREG–2192

United States Nuclear Regulatory Commission

Protecting People and the Environment

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

Draft Report for Comment

Office of Nuclear Reactor Regulation

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Office of Nuclear Reactor Regulation

COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the U.S. Nuclear Regulatory Commission (NRC) staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number **NUREG–2191, Volume 2,** in your comments, and send them by the end of the comment period specified in the *Federal Register* notice announcing the availability of this report.

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Federal Rulemaking Website: Go to http://www.regulations.gov and search for documents filed under Docket ID **NRC–2015–0251**. Address questions about NRC dockets to Carol Gallagher at 301-415-3463 or by e-mail at Carol.Gallagher@nrc.gov.

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ABSTRACT

~~The~~ The U.S. Nuclear Regulatory Commission (NRC) staff has defined subsequent license renewal to be the period of extended operation from 60 years to 80 years following initial licensing. The Standard Review Plan for Review of Subsequent License Renewal Applications (SRP-SLR) for Nuclear Power Plants ~~(SRP-LR)~~ provides guidance to ~~U.S. Nuclear Regulatory Commission (~~NRC~~)~~ staff reviewers in the Office of Nuclear Reactor Regulation. These reviewers perform safety reviews of applications to renew nuclear power plant licenses in accordance with Title 10 of the *Code of Federal Regulations* ~~Part 54. The~~ (10 CFR) Part 54 “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” The NRC regulations in 10 CFR 54.29 establish the standards for issuance of a renewed license. For nuclear power plants that have received a renewed license, the regulations in 10 CFR 54.31(d) state that “a renewed license may be subsequently renewed in accordance with all applicable requirements.” The NRC has stated that the requirements for subsequent renewal “include the provisions of part 54 (unless the Commission subsequently adopts special provisions applicable only to subsequent renewals).” Statement of Consideration, “Nuclear Power Plant License Renewal,” 56 FR 64,943, 64,964-65 (Dec. 13, 1991). To date, the NRC has not adopted special provisions that apply only to subsequent renewal, so that the requirements in 10 CFR Part 54 continues to govern subsequent license renewal.

The principal purposes of the SRP~~-LR~~-SLR are to ensure the quality and uniformity of NRC staff reviews and to present a well-defined base from which to evaluate applicant programs and activities for the subsequent period of extended operation~~.~~, following the first 20-year period of extended operation (i.e., the initial license renewal period). The SRP-~~LR~~SLR also is intended to make regulatory information widely available to enhance communication with interested members of the public and the nuclear power industry and to improve public and industry understanding of the ~~staff~~NRC staff’s review process. The safety review is based primarily on the information provided by the applicant in a subsequent license renewal application. Each of the individual SRP-~~LR~~SLR sections addresses (~~a)~~ i) who performs the review, (~~b~~ii) the ~~matters that are reviewed, (c~~areas of review, (iii) the basis for review, (~~d~~iv) the ~~way the~~method of review ~~is accomplished~~, and (~~e~~v) the conclusions ~~that are drawn.~~ from the review.

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ABBREVIATIONS

~~ACSR~~ACI	~~aluminum conductor steel reinforced~~American Concrete Institute
AFW	auxiliary feedwater
~~AMP~~AMPs	aging management ~~program~~programs
AMR	aging management review
~~ANL~~	~~Argonne National Laboratory~~
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transients without scram
B&PV	Boiler and Pressure Vessel
B&W	Babcock & Wilcox
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CASS	cast austenitic stainless steel
CDF	core damage frequency
CE	Combustion Engineering
CFR	*Code of Federal Regulations*
CLB	current licensing basis
CRD	control rod drive
CRDM	control rod drive mechanism
CUF	cumulative usage factor
DBA	design basis accident
~~DBE~~DBEs	design basis ~~event~~events
DE	Division of Engineering
DG	Draft Regulatory Guide
DIRS	Division of Inspection and Regional Support
DLR	Division of License Renewal
DOR	Division of Operating Reactors
DORL	Division of Operating Reactor Licensing
DPR	Division of Policy and Rulemaking
DSS	Division of Safety Systems
ECCS	emergency core cooling system
~~ECT~~	~~eddy current testing~~
EDG	emergency diesel generator
EFPY	effective full power year
EMA	equivalent margins analysis
EOL	end-of-life
~~EPDM~~	~~ethylene propylene diene monosomer~~
~~EPR~~	~~ethylene-propylene rubber~~
EPRI	Electric Power Research Institute
EPU	extended power uprate
EQ	Environmental Qualification

FAC	flow-accelerated corrosion
FE	further evaluation
FMECA	failure modes, effects, and criticality analysis
FR	*Federal Register*
FRN	*Federal Register Notice*
FSAR	Final Safety Analysis Report
FSER	Final Safety Evaluation Report
GALL	Generic Aging Lessons Learned
GALL-SLR	Generic Aging Lessons Learned for Subsequent License Renewal
GE	General Electric
GL	generic letter
GSI	generic safety issue
~~HAZ~~	~~heat-affected zone~~
~~HDPE~~	~~high-density polyethylene~~
HELB	high-energy line break
HPCI	high-pressure coolant injection
HPSI	high-pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and control
IASCC	Irradiation-assisted stress corrosion cracking
IEEE	Institute of Electrical and Electronics Engineers
~~IGA~~	~~intergranular attack~~
IGSCC	intergranular stress corrosion cracking
IN	information notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
IPE	individual plant examination
IPEEE	individual plant examination of external events
~~IR~~	~~insulation resistance~~
ISI	inservice inspection
ISG	interim staff guidance
~~LCD~~	~~liquid crystal display~~
~~LCO~~LBB	~~limiting conditions of operation~~leak-before-break
~~LED~~ LCOs	~~light-emitting diode~~limiting conditions of operations
LER	licensee event report
LOCA	loss of coolant accident
~~LR~~	~~license renewal~~
~~LRA~~LRAs	license renewal ~~application~~applications
~~LTOP~~LWR	~~low-temperature overpressure protection~~light-water reactor
MEB	metal enclosed bus
MIC	microbiologically-~~influenced~~induced corrosion

~~MEAP~~MRP	~~material/environment/aging effect/program as summarized on AMR line-items~~Materials Reliability Program
~~MRV~~	~~minimum required value~~
~~NDE~~	~~nondestructive examination~~
~~NDT~~	~~nil-ductility temperature~~
NEI	Nuclear Energy Institute
~~NFPA~~	~~National Fire Protection Association~~
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NRR	~~NRC~~ Office of Nuclear Reactor Regulation
~~NSAC~~	~~Nuclear Safety Analysis Center~~
~~NSR~~	~~nonsafety-related~~
~~NSSS~~	~~nuclear steam supply system~~
ODSCC	outside diameter stress corrosion cracking
OE	operating experience
~~OM~~	~~operation and maintenance~~
~~OMB~~	~~Office of Management and Budget~~
P&ID	piping and ~~instrument diagrams~~instrumentation diagram
~~PLL~~PH	~~predicted lower limit~~precipitation-hardened
PM	Project Manager
~~PRA~~	~~probabilistic risk analysis~~
~~PT~~	~~penetrant testing~~
P-T	pressure-temperature
~~PTLR~~PTLRs	pressure-temperature limit reports
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
RAI	request for additional information
~~RCIC~~	~~reactor core isolation cooling~~

~~RCPB~~	~~reactor coolant pressure boundary~~
~~RCS~~	~~reactor coolant system~~
RG	Regulatory Guide
RPV	reactor pressure vessel
RT	reference temperature
RTD	resistance temperature detector
~~RV~~RVI	reactor vessel internal
SBO	station blackout
SC	structures and components
SCC	stress corrosion cracking
SEEIN	Significant Event Evaluation and Information Network
SEs	safety evaluations
SER	safety evaluation report
SG	steam generator
S/G	standards and guides
SLR	subsequent license renewal
SLRA	subsequent license renewal application
SOC	statements of consideration
SOER	significant operating experience report
~~SR~~	~~safety-related~~
~~SR~~	~~silicon rubber~~
SRM	staff requirements memorandum
SRP	standard review plan
SRP-~~LR~~SLR	Standard Review Plan for ~~license renewal~~Review of Subsequent License Renewal Applications for Nuclear Power Plants
SS	stainless steel
~~SSC~~SSCs	systems, structures, and components
SSE	safe shutdown earthquake
TC	thermocouples (nozzles)
TGSCC	transgranular stress corrosion cracking
~~TLAA~~TLAAs	time-limited aging analysis
TR	topical report
TS	Technical Specifications
UFSAR	updated final safety analysis report
USAR	updated safety analysis report
USE	upper-shelf energy
~~USI~~	~~unresolved safety issue~~
~~UT~~	~~ultrasonic testing~~
~~UUSE~~	~~unirradiated upper-shelf energy~~
UV	ultraviolet

~~VHP~~	~~vessel head penetration (nozzles)~~
~~WSLR~~	~~within scope of license renewal~~
~~XPLE~~	~~cross-linked polyethylene~~

INTRODUCTION

The ~~“~~Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants~~”~~ (SRP-~~LR~~SLR) provides guidance to U.S. Nuclear Regulatory Commission (NRC) staff reviewers in the Office of Nuclear Reactor Regulation (NRR). These reviewers perform safety reviews of applications to renew nuclear power plant licenses in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54. The NRC regulations in 10 CFR 54.29 establish the standards for issuance of a renewed license. For nuclear power plants that have received a renewed license, the regulations in 10 CFR 54.31(d) state that “a renewed license may be subsequently renewed in accordance with all applicable requirements.” The NRC has stated that the requirements for subsequent renewal “include the provisions of part 54 (unless the Commission subsequently adopts special provisions applicable only to subsequent renewals).” Statement of Consideration, “Nuclear Power Plant License Renewal,” 56 FR 64,943, 64,964-65 (Dec. 13, 1991). To date, the NRC has not adopted special provisions that apply only to subsequent renewal, so that the requirements in 10 CFR Part 54 continues to govern subsequent license renewal.

The principal purposes of the SRP~~-LR~~-SLR are to ensure the quality and uniformity of the NRC staff ~~reviews~~review and to present a well-defined base from which to evaluate applicant programs and activities for the subsequent period of extended operation. The SRP-~~LR~~SLR also is intended to make regulatory information widely available to enhance communication with interested members of the public and the nuclear power industry and to improve their understanding of the NRC staff review process.

The safety review is based primarily on the information provided by the applicant in a subsequent license renewal application (~~LRA).~~SLRA). The NRC regulation in 10 CFR 54.4 defines what is within the scope of the license renewal rule. The NRC regulation in 10 CFR 54.21 requires ~~that~~ each ~~license renewal~~ application to include an integrated plant assessment (IPA), current licensing basis (CLB) changes during review of the application by the NRC, an evaluation of time-limited aging analyses (TLAAs), and a Final Safety Analysis Report (FSAR) supplement.

In addition to the technical information required by 10 CFR 54.21, an ~~LRA~~SLRA must contain general information (10 CFR 54.19), necessary technical specification changes (10 CFR 54.22), and environmental information (10 CFR 54.23). The application must be sufficiently detailed to permit the reviewers to determine (~~a~~i) whether there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB and (~~b~~ii) whether any changes made to the plant’s CLB to comply with 10 CFR Part 54 are in accordance with the Atomic Energy Act of 1954 and NRC regulations. The technical information to be supplied in the SLRA is specified in 10 CFR 54.21.

Before submitting an ~~LRA~~SLRA, an applicant should have analyzed the plant to ensure that actions have been or will be taken to (~~a~~i) manage the effects of aging during the subsequent period of extended operation ~~(~~[this determination should be based on an assessment of the functionality of structures and components (SCs) that are within the scope of subsequent license renewal and that require an aging management review~~)~~ (AMR)] and (~~b~~ii) evaluate TLAAs. The ~~LRA~~SLRA is the principal document in which the applicant provides the information needed to understand the basis upon which the applicant has made this assurance ~~can be made~~.

~~10 CFR 54.21 specifies, in general terms, the technical information to be supplied in the license renewal application. NRC Regulatory Guide (RG) 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses,” endorses the Nuclear Energy Institute (NEI) guidance in NEI 95-10, “Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 –~~ The ~~License Renewal Rule.” NEI 95-10 provides guidance on the format and content of an LRA.~~ SRP-~~LR sections are keyed to and numbered according to the section numbers in NRC RG 1.188.~~

~~During the review of the initial LRAs, NRC staff and the applicants have found that most of the programs to manage aging that are credited for license renewal are programs already in use by the applicants. 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. In a staff requirements memorandum (SRM) dated August 27, 1999, the NRC approved the staff recommendation and directed the staff to focus the review guidance in the SRP-LR on areas where existing programs should be augmented for license renewal. Under the terms of the SRM, the SRP-LR~~SLR references ~~a “~~the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report~~,”~~, which evaluates existing programs generically, to document (~~a~~i) the conditions under which existing programs are considered adequate to manage identified aging effects without change and (~~b~~ii) the conditions under which existing programs should be augmented for this purpose. The SRP-SLR also includes the NRC staff’s resolutions of License Renewal Interim Staff Guidance (LR-ISG) from 2011 through 2013 as listed below. The NRC issued a draft ISG-2015-01 for public comment on June 29, 2015 (ADAMS No. ML15125A377). The staff is in the final process of reviewing the ISG for issuance as a final document. Upon issuance, the changes to aging management program (AMP) XI.M41, “Buried and Underground Piping and Tanks,” will be incorporated into the GALL- SLR Report ~~(NUREG-1801)~~and the associated section of the SRP- SLR. Under the LR-ISG process the NRC staff, industry, or stakeholders can propose a change to certain license renewal guidance documents. The NRC staff evaluates the issue, develops proposed interim staff guidance (ISG), and issues an ISG for public comment. The NRC reviews any comments received, and, as appropriate, issues a final ISG. The ISG is then used until the NRC staff incorporates it into a formal license renewal guidance document revision.

- LR–ISG–2011–01: Aging Management of Stainless Steel Structures and Components in Treated Borated Water, Revision 1

- LR–ISG–2011–02: Aging Management Program for Steam Generators

- LR–ISG–2011–03: Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program (AMP) XI.M41, “Buried and Underground Piping and Tanks”

- LR–ISG–2011–04: Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors

- LR–ISG–2011–05: Ongoing Review of Operating Experience

- LR–ISG–2012–01: Wall Thinning Due to Erosion Mechanisms

- LR–ISG–2012–02: Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation

- LR–ISG–2013–01: Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks

- LR–ISG–2015–01: Changes to Buried and Underground Piping and Tank Recommendations

The GALL-SLR Report should be treated as an approved topical report. The NRC reviewers should not re-review a matter described in the GALL-SLR Report, but should find an application acceptable with respect to such a matter when the application references the GALL-SLR Report and when the evaluation of the matter in the GALL-SLR Report applies to the plant. However, reviewers should ensure that the material presented in the GALL-SLR Report is applicable to the specific plant involved and that the applicant has identified specific programs, as described and evaluated in the GALL-SLR Report, if they rely on the report for subsequent license renewal~~.~~ (SLR).

The SRP-~~LR~~SLR is divided into ~~four~~five major chapters: ~~(a)~~

Chapter 1—Administrative Information~~; (b)~~

Chapter 2—Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results~~; (c)~~

Chapter 3—Aging Management Review Results~~; and (d)~~

Chapter 4—Time-Limited Aging Analyses~~.~~

Chapter 5—Technical Specifications Changes and Additions

The appendices to the SRP-~~LR~~SLR list branch technical positions. The SRP-~~LR~~SLR addresses various site conditions and plant designs and provides complete procedures for all of the areas of review pertinent to each of the SRP-~~LR~~SLR sections. For any plant-specific application, NRC reviewers may select and emphasize particular aspects of each SRP-~~LR~~SLR section, as appropriate for the application. In some cases, the major portion of the review of a plant program or activity may be ~~done~~conducted 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 that a complete review of the program or activity is not needed. For these and similar reasons, reviewers need not carry out in detail all of the review steps listed in each SRP-~~LR~~SLR section in the review of every application.

The individual SRP-~~LR~~SLR sections address (~~a) who performs~~i) which organization within the NRC staff are to perform the review~~, (b) the matters that are reviewed, (c)~~ ; (ii) areas of review; (iii) the basis for review~~, (d~~; (iv) the ~~way the~~method of review~~ is accomplished,~~; and (~~e~~v) the conclusions ~~that are sought.~~from the review. One of the objectives of the SRP-~~LR~~SLR is to assign review responsibilities to the appropriate NRR branches. Each SRP-~~LR~~SLR section identifies the branch that has the primary review responsibility for that section. In some review areas, the primary branch may require support; the branches ~~that are~~ assigned these secondary review responsibilities also are identified for each SRP~~-LR~~-SLR section.

Each SRP-~~LR~~SLR section is organized into the following six subsections, generally consistent with NUREG~~-~~–0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants” (March 2007, with individual sections subsequently revised as needed).

1. Areas of Review

This subsection describes the scope of review, ~~that is, what is being reviewed by the branch that has primary review responsibility. It~~and 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~~SLRA review. This subsection identifies the branch having the primary review responsibility and provides 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 applicable NRC requirements, and the technical basis for determining the acceptability of programs and activities within the area of review of the SRP-~~LR~~SLR section. The technical bases consist of specific criteria, such as NRC regulatory guides, codes and standards, and branch technical positions.

Consistent with the approach described in ~~NUREG-0800~~Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report, the technical bases for some sections of the SRP-~~LR~~SLR can be provided in branch technical positions or appendices as they are developed and can be included in the SRP-~~LR~~SLR.

3. Review Procedures

This subsection discusses the ~~way the~~ review ~~is accomplished.~~methodology utilized by the NRC staff. It is generally a step-~~-~~by-step procedure that the reviewer follows to ~~provide reasonable verification~~verify that the applicable acceptance criteria have been met.

4. Evaluation Findings

This subsection presents the type of acceptable conclusion that ~~is sought~~may be reached for the particular review area (e.g., the reviewers' determination as to whether the applicant has adequately identified the aging effects and the aging management programs credited with managing the aging effects). For each section, a conclusion of this type is included in the safety evaluation report (SER), in which the reviewers ~~publish~~present the results of their review. The SER also contains a description of the review, including which aspects of the review were selected or emphasized; which matters were modified by the applicant, required additional information, items that will be resolved in the future, or remain unresolved; where the applicant's program deviates from the criteria provided in the SRP-~~LR~~SLR; and the bases for any deviations from the SRP-~~LR~~SLR or exemptions from the regulations.

5. Implementation

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

6. References

This subsection lists the references used in the review process.

The SRP-~~LR~~SLR incorporates the NRC staff experience in the review of license renewal applications. It 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~~SLR is revised and updated periodically, as needed, to incorporate experience gained during recent reviews, to clarify the content or correct errors, to reflect changes in relevant regulations, and to incorporate modifications approved by the NRR Director. A revision number and publication date ~~are~~is printed in ~~a~~the lower corner of each page of each SRP-~~LR~~SLR section. Because individual sections will be revised as needed, the revision numbers and dates may not be the same for all sections.

~~CHAPTER~~ 1 ADMINISTRATIVE INFORMATION

1.1 Docketing of Timely and Sufficient Renewal Application

Review Responsibilities

Primary~~ - ~~—Program responsible for subsequent license renewal projects

Secondary~~ - ~~—Branches responsible for technical review, as appropriate

1.1.1 Areas of Review

This section addresses (~~a~~i) the review of the acceptability of a subsequent license renewal application (SLRA) for docketing in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.101 and the requirements of 10 CFR Part 54 and (~~b~~ii) whether ~~a license renewal~~an application is timely and sufficient, which allows the provisions of 10 CFR 2.109(b) to apply. Application of this regulation, written to comply with the Administrative Procedures Act, means that the current license will not expire until the U.S. Nuclear Regulatory Commission (NRC) makes a final determination on the subsequent license renewal application~~.~~ (SLRA).

The review described in this section is not a detailed, in-depth review of the technical aspects of the application. The docketing and subsequent finding of a timely and sufficient renewal application does not preclude the NRC ~~reviewers~~staff from requesting additional information as the review ~~proceeds, nor~~progresses, and also does ~~it predict~~not imply the NRC's final determination regarding the approval or denial of the renewal application. A plant's current license will not expire upon the passing of the license's expiration date if the renewal application was found to be timely and sufficient. During this time, and~~,~~ until ~~the~~a license renewal ~~application~~determination has been ~~finally determined~~made by the NRC, the licensee must continue to perform its activities in accordance with the facility's current licensing basis (CLB), including all applicable license conditions, orders, rules, and regulations. However, if the NRC staff approves the aging management activities provided in the renewal application before the NRC makes a final determination on the SLRA, the approved applicant may conduct aging management activities during the timely renewal period using the aging management programs (AMPs) included in the SLRA.

To determine whether an application is acceptable for docketing, the following areas of the ~~license renewal application~~SLRA are reviewed.

1.1.1.1 Docketing and Sufficiency of Application

The ~~license renewal application~~SLRA is reviewed for acceptability for docketing as a sufficient application in accordance with 10 CFR 2.101, 10 CFR Part 51, and 10 CFR Part 54.

1.1.1.2 Timeliness of Application

The timeliness of ~~a license renewal application~~an SLRA is reviewed in accordance with 10 CFR 2.109(b).

1.1.2 Acceptance Criteria

1.1.2.1 Docketing~~/~~ and Sufficiency of Application

The NRC staff determines acceptance for docketing and sufficiency on the basis of the required contents of an application, established in 10 CFR 2.101, 10 CFR 51.53(c), 54.17, 54.19, 54.21, 54.22, 54.23, 54.29 and 54.4. ~~A license renewal~~ An application is sufficient if it contains the reports, analyses, and other documents required in such an application.

1.1.2.2 Timeliness of Application

In accordance with 10 CFR 2.109(b), a license renewal application is timely if it is submitted at least 5 years before the expiration of the current operating license (unless an exemption is granted) and if it is determined to be sufficient.

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 NRC, provided that the references are clear and specific. However, the final determination of the sufficiency for docketing of a ~~sufficient~~ renewal application is made only after a formal ~~license renewal application~~SLRA has been submitted to the NRC.

For each area of review, the NRC staff should implement the following review procedures.

1.1.3.1 Docketing and Sufficiency of Application

Upon receipt of a tendered application for subsequent license renewal~~,~~ (SLR), the reviewer should determine whether the applicant has ~~made a reasonable effort to provide~~ provided the required administrative, technical, and environmental information~~ (Ref. 1).~~. The reviewer should use the review checklist provided in Table 1.1~~.1 -~~-1 to determine whether the application is reasonably complete and conforms to the requirements outlined in 10 CFR Part 54.

Items I.1 through I.10 in the checklist address administrative information. For the purpose of this review, the reviewer checks the “Yes” column if the required information is included in the application. Item II in the checklist addresses timeliness of the application.

Items II~~.1 through II.3~~, III, IV, and ~~IV~~V in the checklist address scoping, technical information, the Final Safety Analysis Report (FSAR) supplement, and technical specification changes, respectively. Chapters 2, 3, and 4 of the Standard Review Plan for ~~license renewal~~Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-~~LR~~SLR) provide information regarding the technical review. Although the purpose of the docketing and 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 provides sufficient information to address the items in the checklist so that the NRC staff can begin their technical review. The reviewer should 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~~VI of the checklist addresses environmental information. The environmental review NRC staff should review the supplement to the environmental report prepared by the applicant in accordance with the guidelines in NUREG~~-~~-1555, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants," Supplement 1, "Operating License Renewal" (Ref. ~~2).~~1). The reviewer checks the "Yes" column if the renewal application contains environmental information consistent with the requirements of 10 CFR Part 51.

The application should address each item in the checklist in order to be considered reasonably complete and sufficient. 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 should check the "No" column for that checklist item. Except for Item ~~VI~~VII as discussed in Subsection 1.1.3.2, checking any "No," column indicates that the application is not acceptable for docketing as a sufficient renewal application unless the applicant modifies the application to provide the missing or incomplete information.

If the reviewer concludes, and management concurs, that the application is not acceptable for docketing as a sufficient application, the letter (typically preceded by a management call between the NRC staff and the applicant) to the applicant should clearly state that (~~a~~i) the application is not sufficient and is not acceptable for docketing and (~~b~~ii) the current license will expire at its expiration date. The letter also should include a description of the deficiencies found in the application and offer an opportunity for the applicant to supplement its application to provide the missing or incomplete information. The reviewer should review the supplemented application, if 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 sufficient renewal application. The applicant should be notified by letter that the application is accepted for docketing. Normally, the 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 the license is published in the *Federal Register*~~.~~ (FR).

When the application is acceptable for docketing as a sufficient application, the NRC staff begins its technical review. For ~~license renewal applications~~SLRAs, the NRC maintains the docket number of the current operating license for administrative convenience.

1.1.3.2 Timeliness of Application

If a sufficient application is submitted at least 5 years before the expiration of the current operating license, the reviewer checks the "Yes" column for Item ~~VI~~VII in the checklist. If the supplemented application, as discussed in Subsection 1.1.3.1, is submitted at least 5 years before the expiration of the current operating license, the reviewer checks the “Yes” column for Item ~~VI~~VII in the checklist.

If the reviewer checks the “No” column in Item ~~VI~~VII in the checklist, indicating that a sufficient renewal application has not been submitted at least 5 years before the expiration of the current operating license, the letter (typically preceded by a management call between the NRC staff and the applicant) to the applicant should clearly state that (~~a~~i) the application is not timely, (~~b)~~ ii) the provisions in 10 CFR 2.109(b) have not been satisfied, and (~~c~~iii) the current license will expire on the expiration date. However, if the application is otherwise determined to be acceptable for docketing, the technical review can begin.

1.1.4 Evaluation Findings

The reviewer determines whether sufficient and adequate information has been provided to satisfy the provisions outlined ~~here.~~in Section 1.1.3.1 “Docketing and Sufficiency of Application” above. Depending on the results of this review, one of the following conclusions is included in the NRC staff’s letter to the applicant:

- On the basis of its review, as discussed above, the NRC staff has determined that the applicant has submitted sufficient information that is acceptable for docketing, in accordance with 10 CFR 54.19, 54.21, 54.22, 54.23, 54.4, and 51.53(c). However, the NRC staff’s determination does not preclude the request for additional information as the review proceeds.

- On the basis of its review, as discussed above, the NRC staff has determined that the application is *not acceptable* for docketing as a timely and/or sufficient renewal application.

1.1.5 Implementation

Except for cases in which the applicant proposes an acceptable alternative method for complying with specified portions of NRC regulations, NRC staff members follow the methods described herein~~ are used by NRC staff members~~ in their evaluation of conformance with NRC regulations.

1.1.6 References

~~1.~~ NRC~~ Regulatory Guide 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses,” U.S. Nuclear Regulatory Commission, January 2005.~~

1. . NUREG~~-~~–1555, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants~~,”~~, Supplement 1, ~~“~~Operating License Renewal~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. October 1999.

Table 1.1-1. Acceptance Review Checklist for Subsequent License Renewal Application Acceptability for Docketing

	Yes	No
I. General Information		
1. Application identifies specific unit(s) applying for subsequent license renewal	☐	☐
2. Filing of renewal application 10 CFR 54.17(a) is in accordance with:		
A. 10 CFR Part 2, Subpart A; 10 CFR 2.101	☐	☐
B. 10 CFR 50.4		
a. Application is addressed to the Document Control Desk as specified in 10 CFR 50.4(a)	☐	☐
b. Signed original application and 13 copies are provided to the Document Control Desk. One copy is provided to the appropriate Regional office [10 CFR 50.4(b)(3)]	☐	☐
c. Form of the application meets the requirements of 10 CFR 50.4(c)	☐	☐
C. 10 CFR 50.30		
a. Application is filed in accordance with 10 CFR 50.4 [10 CFR 50.30(a)(1)]	☐	☐
b. Application is 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. 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 or other defense information, if any, is separated from unclassified information in accordance with 10 CFR 50.33(j) [10 CFR 54.17(f)]	☐	☐
8. If the application contains restricted data, written agreement on the control of accessibility to such information 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, as needed, to the standard indemnity agreement have been submitted (10 CFR 140.92, Appendix B) to account for the proposed change in the expiration date [10 CFR 54.19(b)]	☐	☐

Table 1.1-1. Acceptance Review Checklist for Subsequent License Renewal Acceptability for Docketing (Continued)

II. Technical Information

	Yes	No
1. An integrated plant assessment [10 CFR 54.21(a)] is provided, and consists of:		
A. For those SSCs within the scope of license renewal [10 CFR 54.4], identification and listing of those ~~structures and components~~SCs that are subject to an ~~aging management review (~~AMR~~)~~ 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~~SCs subject to an AMR. For commodity groups, description of basis for the grouping	☐	☐
b. Lists of ~~structures and components~~SCs subject to an AMR	☐	☐
B. Description and justification of methods used to identify ~~structures and components~~SCs subject to an AMR [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 intended function(s) of the ~~structures and components~~SCs	☐	☐
b. Identification of applicable aging effects based on materials, environment, operating experience, etc.	☐	☐
c. Identification and description of ~~aging management programs~~AMP	☐	☐
d. Demonstration of aging management provided	☐	☐
2. An evaluation of ~~time-limited aging analyses (~~TLAAs~~)~~ is provided, and consists of:		
A. Listing and description 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)]	☐	☐

Table 1.1-1. Acceptance Review Checklist for Subsequent License Renewal Acceptability for Docketing (Continued)

		Yes	No
III.	**An FSAR supplement [10 CFR 54.21(d)] is provided and contains the following information**:		
	1. Summary description of the ~~aging management programs~~AMPs and activities for managing the effects of aging	☐	☐
	2. Summary description of the evaluation of TLAAs	☐	☐
IV.	**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]	☐	☐
V.	**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]	☐	☐
VI.	**Timeliness Provision**		
	The application is sufficient and submitted at least 5 years before expiration of current license [10 CFR 2.109(b)]. If not, application can be accepted for docketing, but the timely renewal provision in 10 CFR 2.109(b) does not apply	☐	☐
VII.	**Conclusions Regarding Acceptance of Application for Docketing**		
	The application is reasonably complete and meets the Acceptance Review Checklist criteria I through V and is recommended for docketing	☐	☐

~~CHAPTER~~ 2 SCOPING AND SCREENING METHODOLOGY FOR IDENTIFYING STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW AND IMPLEMENTATION RESULTS

2.1 Scoping and Screening Methodology

Review Responsibilities

Primary~~—~~—Assigned branch

Secondary~~—~~—None

2.1.1 Areas of Review

This section addresses the scoping and screening methodology for subsequent license renewal~~.~~ (SLR). As required by Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(a)(2), the applicant, in its integrated plant assessment (IPA), is to describe and justify methods used to identify systems, structures, and components (SSCs) subject to an aging management review (AMR). The SSCs subject to AMR are those that perform an intended function, as described on 10 CFR 54.4, and meet two criteria:

1. They perform such functions without moving parts or without a change in configuration or properties, as set forth in 10 CFR 54.21(a)(1)(i) ~~(~~[denoted as "passive" components and structures in this standard review plan (SRP~~),~~)], and

2. They are not subject to replacement based on a qualified life or specified time period, as set forth in 10 CFR 54.21(a)(1)(ii) ~~(~~[denoted as "long-lived" structures and components~~).~~ (SCs)].

The identification of the SSCs within the scope of ~~license renewal~~SLR is called "scoping." For those SSCs within the scope of ~~license renewal~~SLR, the identification of "passive," "long-lived" ~~structures and components~~SCs that are subject to an AMR is called "screening."

To verify that the applicant has properly implemented its methodology, the U.S. Nuclear Regulatory Commission (NRC) staff reviews the implementation results separately, following the guidance in Sections 2.2 through 2.5.

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) 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 SSCs within the scope of the rule~~;~~
- 10 CFR 54.4(b) as it relates to the identification of the intended functions of plant SSCs determined to be within the scope of the rule~~; and~~
- 10 CFR 54.21(a)(1) and (a)(2) as they relate to the methods utilized by the applicant to identify plant ~~structures and components~~SCs subject to an AMR~~.~~

Specific criteria necessary to determine whether the applicant has met the relevant requirements of 10 CFR 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 used 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 Nuclear Energy Institute (NEI) 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54~~ - ~~—The License Renewal Rule” (Ref. 1), or the justification provided by the applicant for any exceptions should provide a reasonable basis for the exception.

2.1.2.2 Screening

The screening methodology used 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 (Ref. 1), as referenced by Regulatory Guide (RG) 1.188.

2.1.3 Review Procedures

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

- ~~Review of~~ The NRC’s safety evaluation report (SER) that was issued along with the operating license for the facility.
- The SER that was issued on the facility’s license renewal. 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 10 CFR 54.3(a).
- ~~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 SSCs within the facility (including the bases for such nomenclature). During this review, the SSCs should be identified that are relied upon to remain functional during and after design basis events (DBEs), as defined in 10 CFR 50.49(b)(1)(ii), for which the facility was designed, to ensure that the functions described in 10 CFR 54.4(a)(1) are successfully accomplished. This review

should also yield information regarding seismic Category I SSCs as defined in ~~Regulatory Guide~~RG 1.29, “Seismic Design Classification” (Ref. 2). For a newer plant, this information is typically contained in Section 3.2.1, “Seismic Classification,” of the UFSAR consistent with the Standard Review Plan (NUREG~~-~~–0800) (Ref. 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 analyses for the facility. During this review, the SSCs that are relied upon to remain functional during and following design basis events ~~(~~[as defined in 10 CFR 50.49(b)(1~~))~~)] to ensure the functions described in 10 CFR 54.4(a)(1) should be identified.

- The set of ~~design basis events~~DBEs as defined in the rule is not limited to Chapter 15 (or equivalent) of the UFSAR. Examples of ~~design basis events~~DBEs that may not be described in this chapter include external events, such as floods, storms, earthquakes, tornadoes, or hurricanes, and internal events, such as a high-energy line break. Information regarding ~~design basis events~~DBEs as defined in 10 CFR 50.49(b)(1) may be found in any chapter of the facility UFSAR, the Commission’s regulations, NRC orders, exemptions, or license conditions within the CLB. These sources should also be reviewed to identify ~~systems, structures, and components~~SSCs that are relied upon to remain functional during and following ~~design basis events (~~DBEs [as defined in 10 CFR 50.49(b)(1~~))~~)] to ensure the functions described in 10 CFR 54.4(a)(1).

- ~~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. While the license renewal (LR) Rule is “deterministic,” the NRC in the statements of consideration (SOC) accompanying the Rule also states that “In license renewal, probabilistic methods may be most useful, on a plant-specific basis, in helping to assess the relative importance of structures and components that are subject to an ~~aging management review~~AMR by helping to draw attention to specific vulnerabilities (e.g., results of an IPE or IPEEE)” (60 FR 22468). For example, the reviewer should focus on IPE information pertaining to plant changes or modifications that are initiated by the licensee in accordance with the requirements of 10 CFR 50.59 or 10 CFR 50.90.

- ~~Review of~~ The results of the 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 to identify any changes or modifications made to the facility in accordance with the requirements of 10 CFR 50.59 or 10 CFR 50.90.

- ~~Review of~~ The applicant’s docketed correspondence related to the following regulations:

  (a) 10 CFR 50.48, “Fire Protection~~,”~~”

  (b) 10 CFR 50.49, “Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants~~,”~~”

  (c) 10 CFR 50.61, “Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events” or 10 CFR 50.61a, “Alternate fracture toughness requirements for protection against pressurized thermal shock events,” in accordance with the applicant’s CLB [applicable only to pressurized water reactor (PWR) plants~~],~~]

(d) 10 CFR 50.62, “Requirements for Reduction of Risk from Anticipated Transients without Scram Events for Light-Water-Cooled Nuclear Power Plants~~,” and~~”

(e) 10 CFR 50.63, “Loss of All Alternating Current Power” (applicable to PWR plants~~).~~)

Other NRC staff members ~~are~~may be reviewing the applicant’s scoping and screening results separately following the guidance in Sections 2.2 through 2.5. The reviewer should keep these other NRC staff members informed of findings that may affect their review of the applicant’s scoping and screening results. The reviewer should coordinate this sharing of information through the subsequent license renewal (SLR) project manager.

2.1.3.1 Scoping

Once the information delineated above has been gathered, the ~~reviewer~~NRC staff reviews the applicant’s methodology to determine whether its depth and breadth are sufficiently comprehensive to identify the SSCs within the scope of ~~license renewal~~SLR, and the ~~structures and components~~SCs requiring an AMR. 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 FR 22465, May 8, 1995), the regulations, orders, license conditions, exemptions, and ~~technical specifications~~TSs defining functional requirements for facility SSCs that make up an applicant’s CLB should be considered as the initial input into the scoping process. DBEs are defined in 10 CFR 50.49 ~~defines DBEs~~ as conditions of normal operation, including anticipated operational occurrences~~,~~ and design basis accidents (DBAs). DBAs, external events, and natural phenomena for which the plant must be designed to ensure (1) the integrity of the reactor pressure boundary, (2) the capability to shut down the reactor and maintain it in safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 50.67(b)(2), or 100.11, as applicable. Therefore, to determine the safety-related ~~(SR)~~ SSCs that are within the scope of the rule under 10 CFR 54.4 (a)(1), the applicant must identify those SSCs that are relied upon to remain functional during and following these DBEs, consistent with the CLB of the facility. Most licensees have developed lists or databases that identify ~~systems, structures, and components~~SSCs relied on for compliance with other regulations in a manner consistent with the CLB of their facilities. Consistent with the licensing process and regulatory criteria used to develop such lists or databases, licensees should build upon these information sources to satisfy 10 CFR Part 54 requirements.

With respect to technical specifications, the NRC ~~states~~has stated (60 FR 22467):

> 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, the applicant need not consider its technical specifications and applicable limiting conditions of operation when scoping for ~~license renewal.~~SLR. This is not to say that the events and functions addressed within the applicant's technical specifications can be excluded in determining the SSCs within the scope of ~~license renewal~~SLR solely on the basis of such an event's inclusion in the technical specifications. Rather, those SSCs governed by an applicant's technical specifications that are relied upon to remain functional during a DBE, as identified within the applicant's UFSAR, applicable NRC regulations, license conditions, NRC orders, and exemptions, need to be included within the scope of ~~license renewal~~SLR.

For licensee commitments, such as licensee responses to NRC Bulletins, GLs, or enforcement actions, and those documented in NRC staff safety evaluations or licensee event reports, and which make up the remainder of an applicant's CLB, many of the associated SSCs need not be considered under ~~license renewal.~~SLR. Generic communications, safety evaluations, and other similar documents found on the docket are not regulatory requirements, and commitments made by a licensee to address any associated safety concerns are not typically considered to be design requirements. However, any generic communication, safety evaluation, or licensee commitment that specifically identifies or describes a function associated with a ~~system, structure, or component~~SSC 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.~~SLR. For example, NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," states:

> 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~~ Staff's 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 conditions that may affect compliance with the requirements associated with 10 CFR 50.55a and functions specifically related to this regulation that must be considered in the scoping process for ~~license renewal~~SLR.

An applicant may take an approach in scoping and screening that combines similar components from various systems. For example, containment isolation valves from various systems may be identified as a single system for purposes of ~~license renewal~~SLR.

NRC 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 methods document the actual information sources used (for example, those identified in Table 2.1-1).

Table 2.1-2 contains specific NRC staff guidance on certain subjects of scoping.

2.1.3.1.1 Safety-Related

The applicant's methodology is reviewed to ensure that the ~~SR~~safety-related SSCs are identified to satisfactorily accomplish any of the intended functions identified in 10 CFR 54.4(a)(1). The reviewer must ascertain how, and to what extent, the applicant incorporated the information in the CLB for the facility in its methodology. Specifically, the reviewer should 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, DBAs, external events, and natural phenomena for which the plant must be designed to ensure the following functions:

- The integrity of the reactor coolant pressure boundary;
- The capability to shut down the reactor and maintain it in a safe shutdown condition; or
- 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), 50.67(b)(2), or 100.11, as applicable.

2.1.3.1.2 Nonsafety-Related

The applicant's methodology is reviewed to ensure that nonsafety-related ~~(NSR)~~ SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1) are identified as being within the scope of license renewal.

The scoping criterion under 10 CFR 54.4(a)(2), in general, is intended to identify those ~~NSR~~nonsafety-related SSCs that support ~~SR~~safety-related functions. More specifically, this scoping criterion requires an applicant to identify all ~~NSR~~nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified under 10 CFR 54.4(a)(1). Section III.c(iii) of the SOC (60 FR 22467) clarifies the NRC'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, Section III.c(iii) of the SOC provides the following guidance to assist an applicant in determining the extent to which failures must be considered when applying this scoping criterion:

> Consideration of hypothetical failures that could result from system interdependencies 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), the applicant must identify those ~~NSR~~nonsafety-related SSCs (including certain second-, third-, or fourth-level support systems) whose failures are considered in the CLB and could prevent the satisfactory accomplishment of ~~an SR~~a safety-related function identified under 10 CFR 54.4(a)(1). In order to identify such systems, the applicant should consider those failures identified in (1) the documentation that makes up its CLB, (2) plant-specific operating experience, and (3) industrywide operating experience that is specifically applicable to its facility. The applicant need not consider hypothetical failures that are not part of the CLB, have not been previously experienced, or are not applicable to its facility.

In part, 10 CFR 54.4(a)(2) requires that the applicant consider all ~~NSR~~nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), 10 CFR 54.4(a)(1)(ii), or 10 CFR 54.4(a)(1)(iii) to be within the scope of license renewal. By letters dated December 3, 2001 and March 15, 2002, the NRC issued a staff position to NEI ~~which~~that provided NRC staff guidance for determining what SSCs meet the 10 CFR 54.4(a)(2) criterion. The December 3, 2001 letter, "License Renewal Issue: Scoping of Seismic II/I Piping Systems," provided specific examples of operating experience ~~which~~that identified pipe failure events [summarized in Information Notice (IN) 2001-09, "Main Feedwater System Degradation in Safety~~-~~-Related ASME Code Class 2 Piping Inside the Containment of a Pressurized Water Reactor"] and the approaches the NRC considers acceptable to determine which piping systems should be included in scope based on the 10 CFR 54.4(a)(2) criterion.

The March 15, 2002 letter, "License Renewal Issue: Guidance on the Identification and Treatment of Structures, Systems, and Components Which Meet 10 CFR 54.4(a)(2)," further described the NRC staff's recommendations for the evaluation of ~~non-piping~~nonpiping SSCs to determine which additional ~~NSR~~nonsafety-related SSCs are within the scope~~.~~ of SLR. The position states that the applicants should not consider hypothetical failures, but rather should base their evaluation on the plant's CLB, engineering judgment and analyses, and relevant operating experience. The paper further describes operating experience as all documented plant-specific and industrywide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports, plant-specific condition reports, industry reports, such as significant operating experience ~~reports~~report (SOERs), and engineering evaluations.

For example, the safety classification of a pipe at certain locations, such as valves, may change throughout its length in the plant. In these instances, the applicant should identify the ~~SR~~safety-related portion of the pipe as being within the scope of ~~license renewal~~SLR under 10 CFR 54.4(a)(1). However, the entire pipe run, including associated piping anchors, may have been analyzed as part of the CLB to establish that it could withstand DBE loads. If this is the case, a failure in the pipe run or in the associated piping anchors could render the ~~SR~~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 ~~NSR~~nonsafety-related piping up to its anchors and (2) the associated piping anchors as being within the scope of ~~license renewal~~SLR under 10 CFR 54.4(a)(2).

In order to comply, in part, with the requirements of 10 CFR 54.4(a)(2), all applicants must include in scope all ~~NSR~~nonsafety-related piping attached directly to ~~SR~~safety-related piping (within the scope of SLR) up to a defined anchor point consistent with the plant CLB. This anchor point may be served by a true anchor ~~(~~[a device or structure ~~which~~that ensures forces and moments are restrained in three (3) orthogonal directions~~)~~] or an equivalent anchor, such as a large piece of plant equipment (e.g., a heat exchanger,) determined by an evaluation of the plant-specific piping design (i.e., design documentation, such as piping stress analysis for the facility). Applicants should be able to define an equivalent anchor consistent with their CLB (e.g., described in the UFSAR or other CLB documentation), which is being credited for the 10 CFR 54.4(a)(2) evaluation, and be able to describe the SCs that are part of the nonsafety-related piping segment boundary up to and including the anchor point or equivalent anchor point within the scope of SLR.

~~Applicants should be able to define an equivalent anchor consistent with their CLB (e.g., described in the UFSAR or other CLB documentation), which is being credited for the 10 CFR 54.4(a)(2) evaluation, and be able to describe the structures and components that are part of the NSR piping segment boundary up to and including the anchor point or equivalent anchor point within scope of the rule.~~

There may be isolated cases where an equivalent anchor point for a particular piping segment is not clearly described within the existing CLB information. In those instances the applicant may use a combination of restraints or supports such that the ~~NSR~~nonsafety-related piping and associated ~~structures and components~~SCs attached to ~~SR~~safety-related piping is included in scope up to a boundary point ~~which~~that encompasses at least two (2) supports in each of three (3) orthogonal directions.

It is important to note 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 and does not apply to functions identified in 10 CFR 54.4(a)(3), as discussed below.

2.1.3.1.3 “Regulated Events”

The applicant’s methodology is reviewed to ensure that SSCs relied on in safety analyses or plant evaluations to perform functions that demonstrate compliance with the requirements of the fire protection, environmental qualification, pressurized thermal shock (PTS) (applicable only to PWRs), 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 in 10 CFR 54.4(a)(3) require an applicant to consider ~~*“[a]ll*~~‘All systems, structures~~*, systems*~~, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the ~~*[specified] Commission*~~Commission's regulations. . .” In addition, Section III.c(iii) (60 FR 22467) of the SOC states that the NRC 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~~nonsafety-related category ~~include all SSC~~[§ 54.4(a)(2)] to apply to systems, structures, and components whose failure would prevent the accomplishment of an intended function ~~is relied upon to demonstrate compliance with these Commission[ ] regulations.~~of a safety-related system, structure, and component. An applicant for license renewal should rely on the plant’s ~~current licensing bases~~CLB, actual plant-specific experience, ~~industrywide~~industry-wide operating experience, as appropriate, and existing engineering evaluations to determine those ~~SSC~~nonsafety-related systems, structures, and components that are the initial focus of the license renewal review.

Therefore, all SSCs that are relied upon in the plant’s CLB (as defined in 10 CFR 54.3), plant~~-~~-specific experience, industrywide experience (as appropriate), and safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC regulations identified under 10 CFR 54.4(a)(3) are required to be included within the scope of the rule. For example, if ~~an NSR~~a nonsafety-related diesel generator is required for safe shutdown under the fire protection plan, the diesel generator and all SSCs specifically relied upon for that generator to comply with NRC regulations shall be included within the scope of ~~license renewal~~SLR under 10 CFR 54.4(a)(3). Such SSCs may include, but should not be limited to, the cooling water system or systems relied upon for operability, the diesel support pedestal, and any applicable power supply cable specifically relied upon for safe shutdown in the event of a fire.

In addition, the last sentence of the second paragraph in Section III.c(iii) of the SOC provides the following guidance for limiting the application of the scoping criterion 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 interdependencies, that are not part of the current licensing bases and that have not been previously experienced is not required. (60 FR 22467)

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~~under10 CFR 54.4(a)(3). Therefore, in the absence of any 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 under 10 CFR 54.4(a)(3). For example, if ~~an NSR~~a nonsafety-related diesel generator is relied upon only to remain functional to demonstrate compliance with the NRC SBO regulation, the applicant need not consider the following SSCs: (1) an alternate/backup cooling water system, (2) ~~non-seismically~~nonseismically-qualified building walls, or (3) an overhead segment of ~~non-seismically~~nonseismically-qualified piping (in a Seismic II/I configuration). This guidance is not intended to exclude any support system (whether identified by an applicant's CLB, or as indicated from actual plant-specific experience, industrywide experience [as applicable], safety analyses, or plant evaluations) that is specifically relied upon for compliance with the applicable NRC regulation. For example, if analysis of ~~an NSR~~a nonsafety-related diesel generator (relied upon to demonstrate compliance with an applicable NRC regulation) specifically relies upon a second cooling system to cool the diesel generator jacket water cooling system for the generator 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 SSCs whose functions are relied upon to demonstrate compliance with the regulations identified in 10 CFR 54.4(a)(3) (that is, whose functions were credited in the analysis or evaluation). Mere mention of an SSC in the analysis or evaluation does not necessarily constitute support of an intended function as required by the regulation.

For environmental qualification, the reviewer verifies that the applicant has indicated that the environmental qualification equipment is the 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 NRC regulations for environmental qualification (10 CFR 50.49).

~~The PTS regulation is applicable only to PWRs. If the renewal application is for a PWR and the applicant relies on a Regulatory Guide 1.154 (Ref. 5) analysis to satisfy 10 CFR 50.61, as described in the plant's CLB, the reviewer verifies that the applicant's methodology would include SSCs relied on in that analysis.~~

For SBO, the reviewer verifies that the applicant's methodology would include those SSCs relied upon during the "coping duration" and "recovery" phase of an SBO event. In addition, because 10 CFR 50.63(c)(1)(ii) and its associated guidance in ~~Regulatory Guide~~RG 1.155

include procedures to recover from an SBO that include offsite and onsite power, the offsite power system that is used to connect the plant to the offsite power source should also be included within the scope of the rule. However, the ~~staff's~~NRC staff's review is based on the plant-specific ~~current licensing basis~~CLB, regulatory requirements, and offsite power design configurations.

2.1.3.2 Screening

Once the SSCs within the scope of ~~license renewal~~SLR have been identified, the next step is determining which ~~structures and components~~SCs are subject to an AMR (i.e., “screening~~”)~~ ~~(Ref. 1).~~”). Table 2.1-3 contains specific NRC staff guidance on certain subjects of screening.

2.1.3.2.1 “Passive”

The reviewer reviews the applicant’s methodology to ensure that “passive” ~~structures and components~~SCs are identified as those that perform their intended functions without moving parts or a change in configuration or properties in accordance with 10 CFR 54.21(a)(1)(i). The description of “passive” may also be interpreted to include ~~structures and components~~SCs that do not display “a change in state.” 10 CFR 54.21(a)(1)(i) provides specific examples of ~~structures and components~~SCs that do or do not meet the criterion. The reviewer verifies that the applicant’s screening methodology includes consideration of the intended functions of ~~structures and components~~SCs consistent with the plant’s CLB, as typified in Tables 2.1-4(a) and (b), respectively~~ (Ref. 1).~~ .

The license renewal rule focuses on “passive” ~~structures and components~~SCs because ~~structures and components~~SCs 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~~SCs, 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. 2).~~. The description of “passive” may also be interpreted to include ~~structures and components~~SCs that do not display “a change of state.”

Table 2.1-5 provides a list of typical ~~structures and components~~SCs 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 AMR. The applicant does not have to identify pressure-retaining boundaries of this instrumentation because 10 CFR 54.21(a)(1)(i) excludes this instrumentation without exception, unlike pumps and valves. Further, instrumentation is sensitive equipment and degradation of its pressure retaining boundary would be readily determinable by surveillance and testing. If an applicant determines that certain ~~structures and components~~SCs 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~~SCs are identified as those that are not subject to periodic replacement based on a qualified life or specified time period. Passive ~~structures and components~~SCs that are not replaced on the basis of a qualified life or specified time period require an AMR.

Replacement programs may be based on vendor recommendations, plant experience, or any means that establishes a specific replacement frequency under a controlled program. Section f(i)(b) of the SOC provides the following guidance for identifying "long-lived" ~~structures and components~~SCs:

> In sum, a structure or component that is not replaced either (i) on a specified interval based upon the qualified life of the structure or component or (ii) periodically in accordance with a specified time period is deemed by § 54.21(a)(1)(ii) of this rule to be "long-lived," and therefore subject to the § 54.21(a)(3) aging management review [60 FR 22478].

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. 3).~~.

~~Structures and components~~SCs that are replaced on the basis of performance or condition are not generically excluded from an AMR. Rather, performance or condition monitoring may be evaluated later in the IPA as programs to ensure functionality during the period of extended operation. On this topic, Section f(i)(b) of the SOC provides the following guidance:

> It is important to note, however, that the Commission has decided not to generically exclude passive structures and components that are replaced based on performance or condition from an aging management review. Absent the specific nature of the performance or condition replacement criteria and the fact that the Commission has determined that the components with "passive" functions are not as readily ~~monitorable~~monitor able as components with active functions, such generic exclusion is not appropriate. However, the Commission does not intend to preclude a license renewal applicant from providing site-specific justification in a license renewal application that a replacement program on the basis of performance or condition for a passive structure or component provides reasonable assurance that the intended function of the passive structure or component will be maintained in the period of extended operation. [60 FR 22478]

2.1.4 Evaluation Findings

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

> On the basis of its review, as discussed above, the NRC staff concludes that there is reasonable assurance that the applicant's methodology for identifying the systems, structures, and components within the scope of subsequent license renewal and the ~~structures and components~~SCs requiring an ~~aging management review~~AMR 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 NRC regulations, the method described herein will be used by the NRC staff in its evaluation of conformance with NRC regulations~~ (Ref. 6-12 as examples).~~.

2.1.6 References

1. NEI. NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54~~ – ~~–The License Renewal Rule~~," ~~." Revision 6. Washington, DC: Nuclear Energy Institute~~, Revision 6~~.

2. NRC. Regulatory Guide 1.29, ~~Rev. 3,~~ "Seismic Design Classification~~,"~~." Revision 3. Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March 2007.

3. NRC. NUREG~~-~~–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants~~,"~~." Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March 2007.

4. NRC. Generic Letter (GL) 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities-10 CFR 50.54(f~~)," dated~~)." Washington, DC: U.S. Nuclear Regulatory Commission. November ~~23,~~ 1988.

~~2.~~

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

4. ~~NUREG-1723, "Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Stations, Units 1, 2, and 3," March 2000.~~

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

6. ~~Summary of December 8, 1999, Meeting with the Nuclear Energy Institute (NEI) on License Renewal Issue (LR) 98-12, "Consumables," Project No. 690, January 21, 2000.~~

7. ~~Letter to William R. McCollum, Jr., Duke Energy Corporation, from Christopher I. Grimes, NRC, dated October 8, 1999.~~

8. ~~Letter to Alan Nelson, Nuclear Energy Institute, and David Lochbaum, Union of Concerned Scientists, from Christopher I. Grimes, NRC, "License Renewal Issue: Scoping of Seismic II/I Piping Systems," dated December 3, 2001.~~

9. ~~Letter to Alan Nelson, Nuclear Energy Institute, and David Lochbaum, Union of Concerned Scientists, from Christopher I. Grimes, NRC, "License Renewal Issue: Guidance on the Identification and Treatment of Structures, Systems, and Components Which Meet 10 CFR 54.4(a)(2)," dated March 15, 2002.~~

10. ~~Letter to Alan Nelson, Nuclear Energy Institute, and David Lochbaum, Union of Concerned Scientists, from Christopher I. Grimes, NRC, "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout (SBO) Rule (10 CFR 50.63) for License Renewal (10 CFR 54.4(a)(3))," dated April 1, 2002.~~

Table 2.1-1. Sample Listing of Potential Information Sources
Verified databases (databases that are 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
NRC Orders, exemptions, or license conditions for the facility
Design-basis documents
General arrangement or structural outline drawings
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)
Severe Accident Management Guidelines

Table 2.1-2. Specific Staff Guidance on Scoping

Issue	Guidance
Commodity groups	The applicant may also group like ~~structures and components~~SCs into commodity groups. Examples of commodity groups are pipe supports and cable trays. The basis for grouping ~~structures and components~~SCs can be determined by such characteristics as similar function, similar design, and similar materials of construction, similar aging management practices, or similar environments. If the applicant uses commodity groups, the reviewer verifies that the applicant has described the basis for the groups.
Complex assemblies	Some ~~structures and components~~SCs, 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 AMR, 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 make up the complex assembly and determining whether or not each structure and component is subject to an AMR (Ref. 1). NEI 95-10, Revision 0, Appendix C, Example 5 (Ref. ~~10~~1), illustrates how the evaluation boundary for a control room chiller complex assembly might be determined. The control room chillers were purchased as skid-mounted equipment. These chillers are part of the control room chilled water system. There are two (2) control room chillers. Each is a 100~~%~~ percent capacity refrigeration unit. The functions of the control room chillers are to provide a reliable source of chilled water at a maximum temperature of ~~44ºF,~~7 ˚C [44 ˚F], to provide a pressure boundary for the control room chilled water system, to provide a pressure boundary for the service water system, and to provide a pressure boundary for the refrigerant. All of these functions are considered intended functions. Typically, control room chillers are considered as one functional unit; however, for purposes of evaluating the effects of aging, it is necessary to consider the individual components. Therefore, the boundary of each control room chiller is established as follows: 1. At the inlet and outlet flanges of the service water system connections on the control room chiller condenser. Connected piping is part of the service water system. 2. At the inlet and outlet flanges of the control room chilled water system piping connections on the control room chiller evaporator. Connected piping is part of the control room chilled water system. 3. For electrical power supplies, the boundary is the output terminals on the circuit breakers supplying power to the skid. This includes the cables from the circuit breaker to the skid and applies for 480 VAC and 120 VAC. 4. The interface for instrument air supplies is at the instrument air tubing connection to the pressure control regulators, temperature controllers and transmitters, and solenoid valves located on the skid. The tubing

Table 2.1-2. Specific Staff Guidance on Scoping	
Issue	**Guidance**
	from the instrument air header to the device on the skid is part of the instrument air system. 5. The interface with the annunciator system is at the external connection of the contacts of the device on the skid (limit switch, pressure switch, level switch, etc.) that indicates the alarm condition. The cables are part of the annunciator system. Based on the boundary established, the following components would be subject to an ~~aging management review:~~AMR: condenser, evaporator, economizer, chiller refrigerant piping, refrigerant expansion orifice, foundations and bolting, electrical cabinets, cables, conduit, trays and supports, valves
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) industrywide operating experience that is specifically applicable to its facility. The applicant need not consider hypothetical failures that are not part of CLB and that have not been previously experienced. For example, an applicant should consider including (1) the portion of a fire protection system identified in the UFSAR that supplies water to the refueling floor that is relied upon in a DBA 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 intended function as described in the plant's CLB is to protect 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 nonsafety-related piping identified as a Seismic II/I component in the applicant's CLB ~~(Ref. 7).~~.
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 nonsafety-related diesel generator is only relied upon to remain functional to demonstrate compliance with the NRC's SBO 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, industrywide experience, as applicable, or existing engineering evaluations) that is specifically relied upon for compliance with, or operation within, applicable NRC regulation. For example, if the analysis of a nonsafety-related diesel generator (relied upon to demonstrate compliance with an applicable NRC regulation) specifically relies upon 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. 7).~~.

Table 2.1-2. Specific Staff Guidance on Scoping	
Issue	**Guidance**

Table 2.1-3. Specific Staff Guidance on Screening

Issue	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 (e.g., 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). For category (a), the applicant would generally be able to exclude these subcomponents using a clear basis. For category (b), these subcomponents may perform functions without moving parts or a change in configuration, and they are not typically replaced. The applicant's structural AMP should address these items with respect to an AMR program on a plant-specific basis. The consumables in category (c) are usually short-lived and periodically replaced, and can normally be excluded from an AMR on that basis. Likewise, the consumables that fall within category (d) are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from AMR under 10 CFR 54.21(a)(1)(ii). The applicant should identify the standards that are relied on for the replacement as part of the methodology description (for example, NFPA standards for fire protection equipment).
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. Normally 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.
Multiple functions	SCs may have multiple functions. The intended functions as delineated in 10 CFR 54.4(b) are to be reviewed for SLR. For example, a flow orifice that is credited in a plant's accident analysis to limit flow would have two intended functions. One intended function is pressure boundary. The other intended function is to limit flow. The reviewer verifies that the applicant has considered multiple functions in identifying structure- and component-intended functions.

~~Table 2.1-3 Specific Staff Guidance on Screening~~	
~~**Issue**~~	~~**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 (e.g., 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). For category (a), the applicant would generally be able to exclude these subcomponents using a clear basis, such as the example of ASME Section III not being relied on for pressure boundary. For category (b), these subcomponents may perform functions without moving parts or a change in configuration, and they are not typically replaced. The applicant's structural AMP should address these items with respect to an AMR program on a plant-specific basis. The consumables in category (c) are usually short-lived and periodically replaced, and can normally be excluded from an AMR on that basis. Likewise, the consumables that fall within category (d) are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from AMR under 10 CFR 54.21(a)(1)(ii). The applicant should identify the standards that are relied on for the replacement as part of the methodology description (for example, NFPA standards for fire protection equipment) (Ref. 8).**~~**Table 2.1-4(a). Typical "Passive" Structure-Intended Functions**
~~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. Normally 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. 9).~~
~~Multiple functions~~	~~Structures and components may have multiple functions. The intended functions as delineated in 10 CFR 54.4(b) are to be reviewed for license renewal. For example, a flow orifice that is credited in a plant's accident~~

~~Table 2.1-3 Specific Staff Guidance on Screening~~	
~~Issue~~	~~Guidance~~
	~~analysis to limit flow would have two intended functions. One intended function is pressure boundary. The other intended function is to limit flow. The reviewer verifies that the applicant has considered multiple functions in identifying structure- and component-intended functions.~~

~~Table 2.1-4(a) Typical "Passive" Structure-Intended Functions~~	
Structures	
Intended Function	**Description**
Direct Flow	Provide spray shield or curbs for directing flow (e.g., safety injection flow to containment sump)
Expansion/Separation	Provide for thermal expansion and/or seismic separation
Fire Barrier	Provide rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant
Flood Barrier	Provide flood protection barrier (internal and external flooding event)
Gaseous Release Path	Provide path for release of filtered and unfiltered gaseous discharge
Heat Sink	Provide heat sink during station blackout or design-basis accidents
HELB Shielding	Provide shielding against ~~high-energy line breaks (~~HELB~~)~~
Missile Barrier	Provide missile barrier (internally or externally generated)
Pipe Whip Restraint	Provide pipe whip restraint
Pressure Relief	Provide over-pressure protection
Shelter, Protection	Provide shelter/protection to safety-related components
Shielding	Provide shielding against radiation
Shutdown Cooling Water	Provide source of cooling water for plant shutdown
Structural Pressure Barrier	Provide pressure boundary or essentially leak-tight barrier to protect public health and safety in the event of any postulated design-basis events.

Table 2.1-4(b~~)~~). Typical ~~"~~"Passive~~"~~" Component-Intended Functions

Components	
Intended Function	**Description**
Absorb Neutrons	Absorb neutrons
Electrical Continuity	Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals
Insulate (electrical)	Insulate and support an electrical conductor
Filter	Provide filtration
Heat Transfer	Provide heat transfer
Leakage Boundary (Spatial)	Nonsafety-related component that maintains mechanical and structural integrity to prevent spatial interactions that could cause failure of safety-related SSCs
Pressure Boundary	Provide pressure-retaining boundary so that sufficient flow at adequate pressure is delivered, or provide fission product barrier for containment pressure boundary, or provide containment isolation for fission product retention
Spray	Convert fluid into spray
Structural Integrity (Attached)	Nonsafety-related component that maintains mechanical and structural integrity to provide structural support to attached safety-related piping and components
Structural Support	Provide structural and/or functional support to safety~~-~~-related and/or nonsafety-related components
Throttle	Provide flow restriction

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

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/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 Coolant Pressure Boundary Components	Reactor Vessel	Yes
28	Reactor Coolant Pressure Boundary Components	Reactor Coolant Pumps	Yes (Casing)
29	Reactor Coolant Pressure Boundary Components	Control Rod Drives	No
30	Reactor Coolant Pressure Boundary Components	Control Rod Drive Housing	Yes
31	Reactor Coolant Pressure Boundary Components	Steam Generators	Yes
32	Reactor Coolant Pressure Boundary Components	Pressurizers	Yes
33	Non-Class I Piping Components	Underground Piping	Yes
34	Non-Class I Piping Components	Piping in Low Temperature Demineralized Water Service	Yes
35	Non-Class I Piping Components	Piping in High Temperature Single Phase Service	Yes

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
36	Non-Class I Piping Components	Piping in Multiple Phase Service	Yes
37	Non-Class I Piping Components	Service Water Piping	Yes
38	Non-Class I Piping Components	Low Temperature Gas Transport Piping	Yes
39	Non-Class I Piping Components	Stainless Steel Tubing	Yes
40	Non-Class I Piping Components	Instrument Tubing	Yes
41	Non-Class I Piping Components	Expansion Joints	Yes
42	Non-Class I Piping Components	Ductwork	Yes
43	Non-Class I Piping Components	Sprinkler Heads	Yes
44	Non-Class I Piping Components	Miscellaneous Appurtenances (Includes fittings, couplings, reducers, elbows, thermowells, flanges, fasteners, welded attachments, etc.)	Yes
45	Pumps	ECCS Pumps	Yes (Casing)
46	Pumps	Service Water and Fire Pumps	Yes (Casing)
47	Pumps	Lube Oil and Closed Cooling Water Pumps	Yes (Casing)
48	Pumps	Condensate Pumps	Yes (Casing)
49	Pumps	Borated Water Pumps	Yes (Casing)
50	Pumps	Emergency Service Water Pumps	Yes (Casing)
51	Pumps	Submersible Pumps	Yes (Casing)
52	Turbines	Turbine Pump Drives (excluding pumps)	Yes (Casing)
53	Turbines	Gas Turbines	Yes (Casing)
54	Turbines	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	Heat Exchangers	Heating, ventilation, and air conditioning (HVAC) Coolers (including housings)	Yes

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
59	Heat Exchangers	Primary Water System Heat Exchangers	Yes
60	Heat Exchangers	Treated Water System Heat Exchangers	Yes
61	Heat Exchangers	Closed Cooling Water System Heat Exchangers	Yes
62	Heat Exchangers	Lubricating Oil System Heat Exchangers	Yes
63	Heat Exchangers	Raw Water System Heat Exchangers	Yes
64	Heat Exchangers	Containment Atmospheric System Heat Exchangers	Yes
65	Miscellaneous Process Components	Gland Seal Blower	No
66	Miscellaneous Process Components	Recombiners	The applicant shall identify the intended function and apply the IPA process to determine if the grouping is active or passive.
67	Miscellaneous Process Components	Flexible Connectors	Yes
68	Miscellaneous Process Components	Strainers	Yes
69	Miscellaneous Process Components	Rupture Disks	Yes
70	Miscellaneous Process Components	Steam Traps	Yes
71	Miscellaneous Process Components	Restricting Orifices	Yes
72	Miscellaneous Process Components	Air Compressor	No

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
73	Electrical and ~~I&C~~instrumentation and control	Alarm Unit (e.g., fire detection devices)	No
74	Electrical and I&C	Analyzers (e.g., gas analyzers, conductivity analyzers)	No
75	Electrical and I&C	Annunciators (e.g., lights, buzzers, alarms)	No
76	Electrical and I&C	Batteries	No
77	Electrical and I&C	Cables and Connections, Bus, electrical portions of Electrical and I&C Penetration Assemblies, includes fuse holders outside of cabinets of active electrical SCs (e.g., electrical penetration assembly cables and connections, connectors, electrical splices, fuse holders, terminal blocks, power cables, control cables, instrument cables, insulated cables, communication cables, uninsulated ground conductors, transmission conductors, isolated-phase bus, ~~nonsegregated~~non-segregated-phase bus, segregated-phase bus, switchyard bus)	Yes
78	Electrical and I&C	Chargers, Converters, Inverters (e.g., converters-voltage/current, converters-voltage/pneumatic, battery chargers/inverters, motor-generator sets)	No
79	Electrical and I&C	Circuit Breakers (e.g., air circuit breakers, molded case circuit breakers, oil-filled circuit breakers)	No

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
80	Electrical and I&C	Communication Equipment (e.g., telephones, video or audio recording or playback equipment, intercoms, computer terminals, electronic messaging, radios, transmission line traps, and other power-line carrier equipment)	No
81	Electrical and I&C	Electric Heaters	No Yes for a Pressure Boundary if applicable
82	Electrical and I&C	Heat Tracing	No
83	Electrical and I&C	Electrical Controls and Panel Internal Component Assemblies (may include internal devices such as, but not limited to, switches, breakers, indicating lights, etc.) (e.g., main control board, HVAC control board)	No
84	Electrical and I&C	Elements, RTDs, Sensors, Thermocouples, Transducers (e.g., conductivity elements, flow elements, temperature sensors, radiation sensors, watt transducers, thermocouples, RTDs, vibration probes, amp transducers, frequency transducers, power factor transducers, speed transducers, var. transducers, vibration transducers, voltage transducers)	No Yes for a pressure boundary if applicable
85	Electrical and I&C	Fuses	No

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
86	Electrical and I&C	Generators, Motors (e.g., emergency diesel generators, ECCS and emergency service water pump motors, small motors, motor-generator sets, steam turbine generators, combustion turbine generators, fan motors, pump motors, valve motors, air compressor motors)	No
87	Electrical and I&C	High-Voltage Insulators (e.g., porcelain switchyard insulators, transmission line insulators)	Yes
88	Electrical and I&C	Surge Arresters (e.g., switchyard surge arresters, lightning arresters, surge suppressers, surge capacitors, protective capacitors)	No
89	Electrical and I&C	Indicators (e.g., differential pressure indicators, pressure indicators, flow indicators, level indicators, speed indicators, temperature indicators, analog indicators, digital indicators, LED bar graph indicators, LCD indicators)	No
90	Electrical and I&C	Isolators (e.g., transformer isolators, optical isolators, isolation relays, isolating transfer diodes)	No
91	Electrical and I&C	Light Bulbs (e.g., indicating lights, emergency lighting, incandescent light bulbs, fluorescent light bulbs)	No

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
92	Electrical and I&C	Loop Controllers (e.g., differential pressure indicating controllers, flow indicating controllers, temperature controllers, controllers, speed controllers, programmable logic controller, single loop digital controller, process controllers, manual loader, selector station, hand/auto station, auto/manual station)	No
93	Electrical and I&C	Meters (e.g., ammeters, volt meters, frequency meters, var meters, watt meters, power factor meters, watt-hour meters)	No
94	Electrical and I&C	Power Supplies	No
95	Electrical and I&C	Radiation Monitors (e.g., area radiation monitors, process radiation monitors)	No
96	Electrical and I&C	Recorders (e.g., chart recorders, digital recorders, events recorders)	No
97	Electrical and I&C	Regulators (e.g., voltage regulators)	No
98	Electrical and I&C	Relays (e.g., protective relays, control/logic relays, auxiliary relays)	No
99	Electrical and I&C	Signal Conditioners	No
100	Electrical and I&C	Solenoid Operators	No
101	Electrical and I&C	Solid-State Devices (e.g., transistors, circuit boards, computers)	No

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
102	Electrical and I&C	Switches (e.g., differential pressure indicating switches, differential pressure switches, pressure indicator switches, pressure switches, flow switches, conductivity switches, level-indicating switches, temperature-indicating switches, temperature switches, moisture switches, position switches, vibration switches, level switches, control switches, automatic transfer switches, manual transfer switches, manual disconnect switches, current switches, limit switches, knife switches)	No
103	Electrical and I&C	Switchgear, Load Centers, Motor Control Centers, Distribution Panel Internal Component Assemblies (may include internal devices such as, but not limited to, switches, breakers, indicating lights, etc.) (e.g., 4.16 kV switchgear, 480V load centers, 480V motor control centers, 250 VDC motor control centers, 6.9 kV switchgear units, 240/125V power distribution panels)	No
104	Electrical and I&C	Transformers (e.g., instrument transformers, load center transformers, small distribution transformers, large power transformers, isolation transformers, coupling capacitor voltage transformers)	No

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 Grouping**	**Structure, Component, or Commodity Group Meets 10 CFR 54.21(a)(1)(i) (Yes/No)**
105	Electrical and I&C	Transmitters (e.g., differential pressure transmitters, pressure transmitters, flow transmitters, level transmitters, radiation transmitters, static pressure transmitters)	No
106	Valves	Hydraulic-Operated Valves	Yes (Bodies)
107	Valves	Explosive Valves	Yes (Bodies)
108	Valves	Manual Valves	Yes (Bodies)
109	Valves	Small Valves	Yes (Bodies)
110	Valves	Motor-Operated Valves	Yes (Bodies)
111	Valves	Air-Operated Valves	Yes (Bodies)
112	Valves	Main Steam Isolation Valves	Yes (Bodies)
113	Valves	Small Relief Valves	Yes (Bodies)
114	Valves	Check Valves	Yes (Bodies)
115	Valves	Safety Relief Valves	Yes (Bodies)
116	Valves	Dampers, louvers, and gravity dampers	Yes (Housings)
117	Tanks	Air Accumulators	Yes
118	Tanks	Discharge Accumulators (Dampers)	Yes
119	Tanks	Boron Acid Storage Tanks	Yes
120	Tanks	Above Ground Oil Tanks	Yes
121	Tanks	Underground Oil Tanks	Yes
122	Tanks	Demineralized Water Tanks	Yes
123	Tanks	Neutron Shield Tank	Yes
124	Fans	Ventilation Fans (includes intake fans, exhaust fans, and purge fans)	Yes (Housings)
125	Fans	Other Fans	Yes (Housings)
126	Miscellaneous	Emergency Lighting	No
127	Miscellaneous	Hose Stations	Yes

2.2 Plant-Level Scoping Results

Review Responsibilities

Primary~~—~~—Assigned branch(~~es~~s)

Secondary~~—~~—None

2.2.1 Areas of Review

This section addresses the plant-level scoping results for subsequent license renewal~~.~~ (SLR). Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(a)(1) requires the applicant to identify and list structures and components (SCs) subject to an aging management review (AMR). These are “passive,” “long-lived” ~~structures and components~~SCs that are within the scope of ~~license renewal.~~SLR. In addition, 10 CFR 54.21(a)(2) requires the applicant to describe and justify the methods used to identify these ~~structures and components. The~~SCs. The U.S. Nuclear Regulatory Commission (NRC) staff reviews the applicant’s methodology separately, following the guidance in Section 2.1.

The applicant should provide a list of all the plant systems and structures, identifying those that are within the scope of ~~license renewal.~~SLR. If the list exists elsewhere, such as in the updated final safety analysis report (UFSAR), it is acceptable to merely identify the reference. The license renewal rule does not require the identification of all plant systems and structures within the scope of ~~license renewal.~~SLR. However, providing such a list may make the review more efficient.

On the basis of the design basis events (DBEs) considered in the plant’s current licensing basis (CLB) and other CLB information relating to nonsafety-related systems and structures and certain regulated events, the applicant would identify those plant-level systems and structures within the scope of ~~license renewal~~SLR, as defined in 10 CFR 54.4(a). This is “scoping” of the plant- level systems and structures for ~~license renewal.~~SLR. To verify that the applicant has properly implemented its methodology, the NRC 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~~SLR.

Examples of plant systems are the reactor coolant, containment spray, standby gas treatment [boiling water reactor (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 (AFW) systems (PWR).

Examples of plant structures are the primary containment, secondary containment (BWR), control room, 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 plant-level scoping, the applicant should identify the portions of the system or structure that perform an intended function, as defined in 10 CFR 54.4(b). Then the applicant should identify those ~~structures and components~~SCs 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~~SCs are those that are subject to an AMR. The NRC staff reviews these results separately following the guidance in Sections 2.3 through 2.5.

The applicant has the flexibility to determine the set of systems and structures it considers as within the scope of ~~license renewal~~SLR, provided that this set includes the systems and structures that the NRC has determined are within the scope of ~~license renewal.~~SLR. Therefore, the reviewer need not review all systems and structures that the applicant has identified to be within the scope of ~~license renewal~~SLR because the applicant has the option to include more systems and components than those defined to be within the scope of ~~license renewal~~SLR by 10 CFR 54.4.

The following areas 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 Subsequent License Renewal

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

2.2.2 Acceptance Criteria

The acceptance criteria for the area of review define methods for determining whether the applicant has identified the systems and structures within the scope of ~~license renewal~~SLR in accordance with NRC regulations in 10 CFR 54.4. For the applicant’s implementation of its methodology to be acceptable, the NRC staff should have reasonable assurance that there has been no omission of plant-level systems and structures within the scope of ~~license renewal~~SLR.

2.2.2.1 Systems and Structures Within the Scope of Subsequent License Renewal

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

- Safety-related systems and structures that are relied upon to remain functional during and following DBEs [as defined in 10 CFR 50.49(b)(1)] to ensure the following functions:

  – The integrity of the reactor coolant pressure boundary,

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

  – 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), 50.67(b)(2), or 100.11, as applicable.

- All nonsafety-related systems and structures whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1) above.

- All systems and structures relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC regulations for fire protection

(10 CFR 50.48), environmental qualification (10 CFR 50.49), PTS (10 CFR 50.61), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63).

2.2.3 Review Procedures

The reviewer verifies the applicant's scoping and screening results. If the reviewer requests additional information from the applicant regarding why a certain system or structure was not identified by the applicant as being within the scope of ~~license renewal~~SLR for the applicant's plant, the reviewer should provide a focused question, clearly explaining what information is needed, explaining why it is needed, and how it will allow the NRC staff to make its safety finding. In addition, other NRC staff members review the applicant's scoping and screening methodology separately following the guidance in Section 2.1. The reviewer should keep these other NRC staff members informed of findings that may affect their review of the applicant's methodology. The reviewer should coordinate this sharing of information through the ~~license renewal~~SLR project manager.

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

2.2.3.1 Systems and Structures Within the Scope of Subsequent License Renewal

The reviewer determines whether the applicant has properly identified the plant-level systems and structures within the scope of ~~license renewal~~SLR by reviewing selected systems and structures that the applicant did not identify as being within the scope of ~~license renewal~~SLR to verify that they do not have any intended functions.

The reviewer should use the plant UFSAR, orders, applicable regulations, exemptions, and license conditions to determine the design basis for the ~~structures, systems, and components~~ ~~(~~SSCs~~)~~ (if components are identified as "systems" by the applicant). The design basis determines the intended function(s) of an SSC. Such functions determine whether the SSC is within the scope of ~~license renewal~~SLR under 10 CFR 54.4.

This section addresses scoping at a system or structure 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.~~SLR. The review of individual portions of systems and structures that are within the scope of ~~license renewal~~SLR are addressed separately in Sections 2.3 through 2.5.

The applicant should submit a list of all plant-level systems and structures, identifying those that are within the scope of ~~license renewal~~SLR (54.4) and subject to ~~aging management review~~ ~~(~~AMR [54.21(a)(1~~)).~~)]. The reviewer should sample selected systems and structures that the applicant did not identify as within the scope of ~~license renewal~~SLR to determine if they perform any intended functions. The following are examples:

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

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

- The applicant does not identify the fire protection pump house as within the scope of ~~license renewal.~~SLR. 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 plant.

- The applicant uses the "spaces" approach for scoping electrical equipment and elects to include all electrical equipment onsite to be within the scope of ~~license renewal~~SLR except for the 525 kV switchyard and the 230 kV transmission lines. The reviewer may review the UFSAR and commitments to the SBO regulation (10 CFR 50.63) to verify that the 525 kV switchyard and the 230 kV transmission lines do not perform any intended functions at the applicant's plant.

~~Table 2.2-1 contains additional examples based on lessons learned from the review of the initial license renewal applications, including a discussion of the plant-specific determination of whether a system or structure is within the scope of license renewal.~~

The applicant may choose to group similar components and structures together in commodity groups for separate analyses. If only a portion of a system or structure has an intended function and is addressed separately in a specific commodity group, it is acceptable for an applicant to identify that system or structure as not being within the scope of ~~license renewal.~~SLR. However, for completeness, the applicant should include some reference indicating that the portion of the system or structure with an intended function that is evaluated with the commodity group.

Section 2.1 contains additional guidance on the following:

- Commodity groups
- Complex assemblies
- Hypothetical failure
- Cascading

If the reviewer has reviewed systems and structures in sufficient detail and does not identify any omissions of systems and structures from those within the scope of ~~license renewal, the~~SLR, the NRC staff would have reasonable assurance that the applicant has identified the systems and structures within the scope of SLR.

If the reviewer determines that the applicant has satisfied the criteria described in this review section, the NRC staff would have reasonable assurance that the applicant has identified the systems and structures within the scope of ~~license renewal.~~SLR.

~~If the reviewer determines that the applicant has satisfied the criteria described in this review section, the staff would have reasonable assurance that the applicant has identified the systems and structures within the scope of license renewal.~~

2.2.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of the SRP-~~LR~~SLR, then the NRC staff's evaluation supports conclusions of the following type, to be included in the ~~safety evaluation report~~SER:

> On the basis of its review, as discussed above, the NRC staff concludes that there is reasonable assurance that the applicant has appropriately identified the systems and structures within the scope of ~~license renewal~~SLR 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 NRC regulations, the method described herein will be used by the NRC staff in its evaluation of conformance with NRC regulations.

2.2.6 References

1. NRC. Regulatory Guide 1.29, ~~Rev. 3,~~ “Seismic Design Classifications~~,”~~.” Revision 3. Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March 2007.

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 via the spent fuel pool cooling system. However, the spent fuel pool cooling system at the subject facility is not safety-related, and, following a seismic event, the safety~~-~~-related spent fuel pool structure and spent fuel pool makeup water supplies ensure the adequate removal of decay heat to prevent potential offsite exposures comparable to those described in 10 CFR Part 100. Therefore, the recirculation cooling water system is not within the scope of ~~license renewal~~SLR based on the spent fuel decay heat removal function.
SBO diesel generator building	The plant's UFSAR indicates that certain structural components of the SBO 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 equipment attached to the roof of the building has been anchored to resist tornado wind loads. Thus, the SBO diesel generator building is within the scope of ~~license renewal~~SLR.

2.3 Scoping And Screening Results: Mechanical Systems

Review Responsibilities

Primary~~—~~—Assigned branch(~~es~~s)

Secondary~~—~~—None

2.3.1 Areas of Review

This section addresses the mechanical systems scoping and screening results for subsequent license renewal~~.~~ (SLR). Typical mechanical systems consist of the following:

- Reactor coolant system (such as reactor vessel and internals, components forming part of coolant pressure boundary, coolant piping 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 systems, suppression pool cleanup system, load handling system, open and closed cycle cooling water systems, ultimate heat sink, compressed air system, chemical and volume control system, standby liquid control system, coolant storage/refueling water systems, ventilation systems, diesel generator system, and fire protection system).
- Steam and power conversion system (such as turbines, main and extraction steam, feedwater, condensate, steam generator blowdown, and auxiliary feedwater).

Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(a)(1) requires an applicant to identify and list structures and components (SCs) subject to an aging management review (AMR). These are "passive," "long-lived" ~~structures and components~~SCs that are within the scope of ~~license renewal (WSLR).~~SLR. In addition, 10 CFR 54.21(a)(2) requires an applicant to describe and justify the methods used to identify these ~~structures and components. The~~SCs. The U.S. Nuclear Regulatory Commission (NRC) staff reviews the applicant's methodology separately following the guidance in Section 2.1. To verify that the applicant has properly implemented its methodology, the NRC staff focuses its review on the implementation results. Such a focus allows the NRC staff to confirm that there is no omission of mechanical system components that are subject to an AMR by the applicant. If the review identifies no omission, the NRC staff has the basis to find that there is reasonable assurance that the applicant has identified the mechanical system components that are subject to an AMR.

An applicant should list all plant-level systems and structures. On the basis of the design basis events (DBEs) considered in the plant's current licensing basis (CLB) and other CLB information relating to nonsafety-related systems and structures and certain regulated events, the applicant should identify those plant-level systems and structures ~~WSLR~~within the scope of SLR, as defined in 10 CFR 54.4(a). This is "scoping" of the plant-level systems and structures for ~~license renewal.~~SLR. The NRC staff reviews the applicant's plant-~~-~~level "scoping" results separately following the guidance in Section 2.2.

For a mechanical system that is within the scope of ~~license renewal~~SLR, the applicant should identify the portions of the system that perform an intended function, as defined in 10 CFR 54.4(b). The applicant may identify these particular portions of the system in marked-up piping and instrument diagrams (P&IDs) or in other media. This is “scoping” of mechanical components in a system to identify those that are ~~WSLR~~within the scope of SLR for a system.

For those identified mechanical components that are ~~WSLR~~within the scope of SLR, the applicant must identify those that are “passive” and “long-lived,” as required by 10 CFR 54.21(a)(1)(i) and (ii). These “passive,” “long-lived” mechanical components are those that are subject to an AMR. 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~~SCs for which an AMR is performed, provided that this set includes the ~~structures and components~~SCs for which the NRC has determined that an AMR is required. This is based on the Statements of Consideration ~~(SOC)~~ for the license renewal rule (60 FR 22478). Therefore, the reviewer need not review all components that the applicant has identified as subject to an AMR because the applicant has the option to include more components than those required to be subject to an AMR pursuant to 10 CFR 54.21(a)(1).

2.3.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for determining whether the applicant has met the requirements of NRC regulations in 10 CFR 54.21(a)(1). For the applicant’s implementation of its methodology to be acceptable, the NRC staff should have reasonable assurance that there has been no omission of mechanical system components that are subject to an AMR.

2.3.2.1 Components Within the Scope of Subsequent License Renewal

Mechanical components are ~~WSLR~~within the scope of SLR as delineated in 10 CFR 54.4(a) if they are

- Safety-related systems, structures, ~~systems, or~~and components (SSCs) that are relied upon to remain functional during and following DBEs [as defined in 10 CFR 50.49(b)(1)] to ensure the following functions:

  — The integrity of the reactor coolant pressure boundary;

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

  — 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), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable.

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

- All SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (PTS) (10 CFR 50.61), ~~ATWS~~anticipated transients without scram (10 CFR 50.62), and ~~SBO~~station blackout (10 CFR 50.63).

2.3.2.2 Components Subject to an Aging Management Review

Mechanical components are subject to an AMR if they are ~~WSLR~~within the scope of SLR and perform an intended function as defined in 10 CFR 54.4(b) without moving parts or 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

The reviewer verifies the applicant's scoping and screening results. If the reviewer requests additional information from the applicant regarding why a certain component was not identified by the applicant as being ~~WSLR~~within the scope of SLR or subject to an AMR for the applicant's plant, the reviewer should provide a focused question that clearly explains what information is needed, why the information is needed, and how the information will allow the NRC staff to make its safety finding. In addition, other NRC staff members review the applicant's scoping and screening methodology separately, following the guidance in Section 2.1. The reviewer should keep these other NRC staff members informed of findings that may affect their review of the applicant's methodology. The reviewer should coordinate this sharing of information through the ~~license renewal~~SLR project manager.

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

2.3.3.1 Components Within the Scope of Subsequent License Renewal

In this step, the NRC staff determines whether the applicant has properly identified the components that are ~~WSLR.~~within the scope of SLR. The Rule requires applicants to identify components that are ~~WSLR~~within the scope of SLR and subject to an AMR. In the past, LRAs have included a table of components that are ~~WSLR~~within the scope of license renewal; that information need not be submitted with ~~future LRAs.~~SLRAs. Although a list of ~~WSLR~~within the scope of SLR components will be available at plant sites for inspection, the reviewer should determine through sampling of P&IDs, and review of the updated final safety analysis report (UFSAR) and other plant documents, what portion of the components are within the scope~~.~~ of SLR. The reviewer should check to see if any components exist that the NRC staff believes are within the scope of SLR but are not identified by the applicant as being subject to an AMR (and request that the applicant provide justification for omitting those components that are "passive" and "long-lived").

The reviewer should use the UFSAR, orders, applicable regulations, exemptions, and license conditions to determine the design basis for the SSCs. The design basis specifies the intended function(s) of the system(s). That intended function is used to determine the components within that system that are relied upon for the system to perform its intended functions.

The reviewer should focus the review on those components that are not identified as being ~~WSLR~~within the scope of SLR, especially the ~~license renewal~~SLR boundary points and major flow paths. The reviewer should verify that the components do not have intended functions. Portions of the system identified as being ~~WSLR~~within the scope of SLR by the applicant do not have to be reviewed because the applicant has the option to include more components within the scope than the rule requires.

Further, the reviewer should select system functions described in the UFSAR that are required by 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the rule.

For example, if a reviewer verifies that a portion of a system does not perform an intended function, is not identified as being subject to an AMR by the applicant, and is isolated from the portion of the system that is identified as being subject to an AMR by a boundary valve, the reviewer should verify that the boundary valve is subject to an AMR, or that the valve is not necessary for the within-scope portion of the system to perform its intended function. Likewise, the reviewer should identify, to the extend practical, the system functions of the piping runs and components that are identified as not being ~~WSLR~~within the scope of SLR to ensure they do not have intended functions that meet the requirements of 10 CFR 54.4.

Section 2.1 contains additional guidance on the following:

- Commodity groups
- Complex assemblies
- Hypothetical failure
- Cascading

If the reviewer has reviewed components in sufficient detail and does not identify any omissions of components ~~WSLR~~within the scope of SLR, the reviewer would have reasonable assurance that the applicant has identified the components ~~WSLR~~within the scope of SLR for the mechanical systems.

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

2.3.3.2 Components Subject to an Aging Management Review

In this step, the reviewer determines whether the applicant has properly identified the components subject to an AMR from among those ~~which~~that are ~~WSLR~~within the scope of SLR renewal (i.e., those identified in Subsection 2.3.3.1). The reviewer should review selected components that the applicant has identified as ~~WSLR~~within the scope of SLR but as not subject to an AMR. The reviewer should verify that the applicant has not omitted, from an AMR, components that perform intended functions without moving parts or without a change in configuration or properties and that 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, the reviewer should sample components that are ~~WSLR~~within the scope of SLR for that system, but were not identified by the applicant as subject to an AMR. Only components that are "passive" and "long-lived" are subject to an AMR. Table 2.1-5 is provided for the reviewer to assist in identifying whether certain components are "passive." The applicant should justify omitting a component from an AMR that is ~~WSLR~~within the scope of SLR at their facility and is listed as "passive" on Table 2.1-5. Although Table 2.1-5 is extensive, it may not be all-inclusive. Thus, the reviewer should use other available information sources, such as prior application reviews, to determine whether a component may be subject to an AMR.

For example, an applicant has marked a boundary of a certain system that is ~~WSLR.~~within the scope of SLR. The marked-up diagram shows that there are pipes, valves, and air compressors within this boundary. The applicant has identified piping and valve bodies as subject to an AMR. Because Table 2.1-5 indicates that air compressors are not subject to an AMR, the reviewer should find the applicant's determination acceptable.

Section 2.1 contains additional guidance on screening the following:

- Consumables
- Heat exchanger-intended functions
- Multiple functions

If the reviewer does not identify any omissions of components from those that are subject to an AMR, the NRC staff would then have reasonable assurance that the applicant has identified the components subject to an AMR for the mechanical systems.

Table 2.3-2 provides examples of mechanical components screening developed from lessons learned during the review of the initial ~~license renewal~~SLR applications and bases for their disposition.

If the applicant determines that a component is subject to an AMR, the applicant should also identify the component's intended function, as defined in 10 CFR 54.4. Such functions must be maintained by any necessary AMRs. Table 2.3-3 provides examples of mechanical component~~-~~-intended functions.

2.3.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of the Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-~~LR,~~SLR), then the NRC staff's evaluation ~~supports~~would support conclusions of the following type, to be included in the ~~safety evaluation report~~SER:

> On the basis of its review, as discussed above, the NRC staff concludes that there is reasonable assurance that the applicant has appropriately identified the mechanical system components within the scope of subsequent license renewal, as required by 10 CFR 54.4, and that the applicant has adequately identified the system components subject to an ~~aging management review~~AMR in accordance with 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 NRC regulations, the method described herein will be used by the NRC staff in its evaluation of conformance with NRC 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/nonsafety-related boundary along a pipe run may occur at a valve location. The nonsafety-related piping segment between this valve and the next seismic anchor provides structural support in a seismic event. This piping segment is ~~WSLR~~within the scope of SLR.
Containment heating and ventilation system ductwork downstream of the fusible links providing cooling to the steam generator compartment and reactor vessel annulus	This nonsafety-related ductwork provides cooling to support the applicant's environmental qualification 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 event.~~DBE. Thus, this ductwork is not ~~WSLR~~within the scope of SLR.
Standpipe installed inside the fuel oil storage tank	The standpipe as described in the applicant's CLB ensures that there is sufficient fuel oil reserve for the emergency diesel generator to operate for the number of days specified in the plant technical specifications following DBEs. Therefore, this standpipe is ~~WSLR~~within the scope of SLR.
Insulation on boron injection tank	The temperature is high enough that insulation is not necessary to prevent boron precipitation. The plant 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 ~~WSLR~~within the scope of SLR.
Pressurizer spray head	The spray head is not credited for the mitigation of any accidents addressed in the UFSAR accident analyses for many plants. The function of the pressurizer spray is to reduce reactor coolant system pressure during normal operating conditions. However, some plants rely on this component for pressure control to achieve cold shutdown during certain fire events. Failure of the spray head should be evaluated in terms of any possible damage to surrounding safety grade components, in addition to the need for spray. Therefore, this component should be evaluated on a plant-~~-~~specific basis.

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 AMR for ~~license renewal~~SLR 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 AMR.
Valve internals (such as disk and seat)	10 CFR 54.21(a)(1)(i) excludes valves, other than the valve body, from AMR. The statements of consideration of the license renewal rule provide the basis for excluding ~~structures and components~~SCs that perform their intended functions with moving parts or with a change in configuration or properties. Although the valve body is subject to an AMR, valve internals are not.

Table 2.3-3. Examples of Mechanical Component-Intended Functions	
Component	**Intended ~~Function[a]~~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
~~a~~ *The component-intended functions are those that support the system-intended functions. 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 Scoping and Screening Results: Structures

Review Responsibilities

Primary~~–~~—Assigned branch(~~es~~s)

Secondary~~–~~—None

2.4.1 Areas of Review

This section addresses the scoping and screening results of structures and structural components for subsequent license renewal~~.~~ (SLR). 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~~heating, ventilation, and air conditioning (HVAC) ducting supports);
- ~~Nonsafety~~Non-safety-related structures whose failure could prevent safety-related systems, structures, ~~systems,~~ and components (SSCs) from performing their intended functions (~~that is,~~e.g., seismic Category II structures over Category I structures).

Typical structural components include the following: (i) liner plates, (ii) walls, (iii) floors, (iv) roofs, (v) foundations, (vi) doors, (vii) beams, (viii) columns, and (ix) frames.

Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(a)(1) requires an applicant to identify and list structures and components (SCs) subject to an aging management review (AMR). These are "passive," "long-lived" ~~structures and components~~SCs that are within the scope of ~~license renewal (WSLR).~~SLR. In addition, 10 CFR 54.21(a)(2) requires an applicant to describe and justify the methods used to identify these ~~structures and components. The~~SCs. The U.S. Nuclear Regulatory Commission (NRC) staff reviews the applicant's methodology separately following the guidance in Section 2.1. To verify that the applicant has properly implemented its methodology, the NRC staff focuses its review on the implementation results. Such a focus allows the NRC staff to confirm that there is no omission of structures that are subject to an AMR by the applicant. If the review identifies no omission, the NRC staff has the basis to find that there is reasonable assurance that the applicant has identified the ~~structural components~~SCs that are subject to an AMR.

An applicant should list all plant-level systems and structures. On the basis of the design basis events (DBEs) considered in the plant's current licensing basis (CLB) and other CLB information relating to nonsafety-related systems and structures and certain regulated events, the applicant should identify those plant-level systems and structures ~~WSLR~~within the scope of SLR, as defined in 10 CFR 54.4(a). This is "scoping" of the plant-level systems and structures for ~~license renewal.~~SLR. The NRC staff reviews the applicant's plant-level "scoping" results separately following the guidance in Section 2.2.

For structures that are ~~WSLR~~within the scope of SLR, an applicant must identify the ~~structural components~~SCs 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~~SCs are subject to an AMR ("screening"). The applicant's methodology implementation results for identifying ~~structural components~~SCs subject to an AMR is the area of review.

The applicant has the flexibility to determine the set of ~~structures and components~~ SCs for which an AMR is performed, provided that this set includes the ~~structures and components~~SCs for which the NRC has determined that an AMR 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 AMR because it is an applicant's option to include more ~~structural components~~SCs than those subject to an AMR, pursuant to 10 CFR 54.21(a)(1). Rather, the reviewer should focus on those ~~structural components~~SCs that are not included by the applicant as subject to an AMR 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 determining whether the applicant has met the requirements of NRC regulations in 10 CFR 54.21(a)(1). For the applicant's implementation of its methodology to be acceptable, the NRC staff should have reasonable assurance that there has been no omission of ~~structural components~~SCs that are subject to an AMR.

2.4.2.1 Structural Components Subject to an Aging Management Review

Structural components are ~~WSLR~~within the scope of SLR as delineated in 10 CFR 54.4(a) if they are

- Safety-related ~~SSCs~~systems, structures, and components that are relied upon to remain functional during and following DBEs [as defined in 10 CFR 50.49(b)(1)] to ensure the following functions:
  - — The integrity of the reactor coolant pressure boundary;
  - — The capability to shut down the reactor and maintain it in a safe shutdown condition; or
  - — 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), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable.
- All nonsafety-related ~~SSCs~~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).
- ~~All SSCs~~All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (PTS)

(10 CFR 50.61), anticipated transients without scram (ATWS) (10 CFR 50.62), and station blackout (SBO) (10 CFR 50.63).

Structural components are subject to an AMR if they are ~~WSLR~~within the scope of SLR and perform an intended function as defined in 10 CFR 54.4(b) without moving parts or 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

The reviewer verifies the applicant’s scoping and screening results. If the reviewer requests additional information from the applicant regarding why a certain structure was not identified by the applicant as being ~~WSLR~~within the scope of SLR or subject to an AMR for the applicant’s plant, the reviewer should provide a focused question that clearly explains what information is needed, why the information is needed, and how the information will allow the NRC staff to make its safety finding. In addition, other NRC staff members review the applicant’s scoping and screening methodology separately following the guidance in Section 2.1. The reviewer should keep these other NRC staff members informed of findings that may affect their review of the applicant’s methodology. The reviewer should coordinate this sharing of information through the ~~license renewal~~SLR project manager.

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

2.4.3.1 Structural Components Within the Scope of Subsequent License Renewal

In this step, the NRC staff determines which structures and structural components are ~~WSLR.~~within the scope of subsequent license renewal. The Rule requires applicants to identify structures that are subject to an AMR, but not structures that are ~~WSLR.~~within the scope of subsequent license renewal. Whereas, in the past, LRAs have included a table of structures that are ~~WSLR~~within the scope of license renewal, that information need not be submitted with future ~~LRAs.~~SLRAs. Although that information will be available at plant sites for inspection, the reviewer should determine through sampling of ~~P&IDs~~piping and instrumentation diagram piping and instrumentation diagram and through review of the updated final safety analysis report (UFSAR) and other plant documents what portion of the components are within the scope~~.~~ of SLR. The reviewer should check to see if any structures exist that the NRC staff believes are within the scope of SLR but are not identified by the applicant as being subject to an AMR (and request that the applicant provide justification for omitting those structures that are “passive” and “long~~-~~-lived”).

2.4.3.2 Structural Components Subject to an Aging Management Review

In general, structural components are “passive” and “long-lived.” Thus, they are subject to an AMR if they are ~~WSLR.~~within the scope of SLR. For each of the plant-level structures ~~WSLR~~within the scope of SLR, an applicant should identify those structural components that have intended functions. For example, the applicant may identify that its auxiliary building is ~~WSLR.~~within the scope of SLR. For this auxiliary building, the applicant may identify the structural components of beams, concrete walls, blowout panels, etc., that are subject to an AMR. The applicant should justify omitting a component from an AMR that is ~~WSLR~~within the scope of SLR at its facility and is listed as “passive” on Table 2.1-5. Although Table 2.1-5 is extensive, it may not be all-inclusive. Thus, the reviewer should use other available information, such as prior application reviews, to determine whether a component may be subject to an AMR.

As set forth below, the reviewer should focus on individual structures not subject to an AMR, one at a time, to confirm that the structural components that have intended functions have been identified by the applicant. In a few instances, only portions of a particular building are ~~WSLR.~~within the scope of SLR. For example, a portion of a particular turbine building provides shelter for some safety-related equipment, which is an intended function, and the remainder of this particular building does not have any intended functions. In this case, the reviewer should verify that the applicant has identified the relevant particular portion of the turbine building as being ~~WSLR~~within the scope of SLR and subject to an AMR.

The reviewer should use the UFSAR, orders, applicable regulations, exemptions, and license conditions to determine the design basis for the SSCs. The design basis specifies the intended function(s) of the system(s). That intended function is used to determine the components within that system that are relied upon for the system to perform its intended functions.

The reviewer should focus the review on those structural components that have not been identified as being ~~WSLR.~~within the scope of SLR. For example, for a building ~~WSLR~~within the scope of SLR, if an applicant did not identify the building roof as subject to an AMR, the reviewer should verify that the roof has no intended functions, such as a “Seismic ~~II~~Category II structures over Category I structures” concern in accordance with the plant’s CLB. The reviewer need not verify all structural components that have been identified as subject to an AMR by the applicant because the applicant has the option to include more structural components than the rule requires.

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 review. 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 being ~~WSLR.~~within the scope of SLR. Similarly, if a nonsafety-related structure or component is included in the ~~plant's~~plant’s CLB as a part of the safe shutdown path resulting from the resolution of ~~the~~ unresolved safety issue~~,~~ (USI) A-46 (Ref. 1), the reviewer should verify that the structure or component has been included ~~WSLR~~within the scope of SLR.

The applicant should also identify the intended functions of structural components. Table 2.1-4 provides typical “passive” structural component-intended functions.

The NRC staff has developed additional scoping/screening guidance (Ref. 2). For example, some structural components may be grouped together as a commodity, such as pipe hangers, and some structural components are considered consumable materials, such as sealants. Additional guidance on these and ~~others~~other components are contained in Section 2.1 for the following:

- Commodity groups
- Hypothetical failure
- Cascading
- Consumables
- Multiple functions

If the reviewer does not identify any omissions of components from those that are subject to an AMR, the NRC staff would have reasonable assurance that the applicant has identified the components subject to an AMR for the structural systems.

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

If the applicant determines that a structural component may be subject to an AMR, the applicant should also identify the component's intended functions, as defined in 10 CFR 54.4. Such functions must be maintained by any necessary ~~AMPs~~aging management programs.

If the reviewer determines that the applicant has satisfied the criteria described in this review section, the NRC staff would have reasonable assurance that the applicant has identified the components that are ~~WSLR~~within the scope of SLR and subject to an AMR.

2.4.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of the ~~SRP-LR,~~Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants, then the NRC staff's evaluation ~~supports~~would support conclusions of the following type, to be included in the safety evaluation report:

> On the basis of its review, as discussed above, the NRC staff concludes that there is reasonable assurance that the applicant has appropriately identified the structural components subject to an ~~aging management review~~AMR in accordance with 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 NRC regulations, the method described herein will be used by the NRC staff in its evaluation of conformance with NRC regulations.

2.4.6 References

2. NRC. NUREG~~-~~–1211, ~~"~~“Regulatory Analysis for Resolution of Unresolved Safety Issue A~~-~~-46, ~~`~~Seismic Qualification of Equipment in Operating Plants~~,"~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. February 1987.

3. NRC. NUREG~~-~~–0933, ~~"~~“Resolution of Generic Safety Issues~~,”~~.” Supplement 32~~,~~. Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. August 2008

~~4. .~~

Table 2.4-1. Examples of Structural Components Scoping/Screening and Basis for Disposition	
Example	**Disposition**
Roof of turbine building	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 SSCs in the basement, which would remain sheltered and protected by several reinforced concrete floors if the turbine building roof were to degrade. Because this roof does not perform an intended function, it is not ~~WSLR~~within the scope of subsequent 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 DBA with no loss of structural integrity. Although the tendon gallery is not relied on to maintain containment integrity during DBEs, 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 tendon anchorages, including those in the gallery, will continue to perform their intended functions. Because the tendon gallery itself does not perform an intended function, it is not ~~WSLR~~within the scope of subsequent license renewal.
Water-stops	Ground water leakage into the auxiliary building could occur as a result of degradation to the water-stops. This leakage may cause flooding of equipment ~~WSLR.~~within the scope of subsequent license renewal. (The plant's UFSAR discusses the effects of flooding.) The water-stops perform their functions without moving parts or a change in configuration, and they are not typically replaced. Thus, the water-stops are subject to an AMR. 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 AMR.

2.5 Scoping and Screening Results: ~~ELECTRICAL AND INSTRUMENTATION AND~~ Electrical And Instrumentation and Controls Systems

Review Responsibilities

Primary ~~—~~ —Assigned branch(~~es~~s)

Secondary ~~—~~ —None

2.5.1 Areas of Review

This review plan section addresses the electrical and instrumentation and ~~controls~~control (I&C) scoping and screening results for subsequent license renewal~~.~~ (SLR). Typical electrical and I&C components that are subject to an aging management review (AMR) for ~~license renewal~~SLR include electrical cables and connections.

Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(a)(1) requires an applicant to identify and list structures and components (SCs) subject to an AMR. These are “passive,” “long-lived” ~~structures and components~~SCs that are within the scope of ~~license renewal (WSLR).~~SLR. In addition, 10 CFR 54.21(a)(2) requires an applicant to describe and justify the methods used to identify these ~~structures and components. The~~SCs. The U.S. Nuclear Regulatory Commission (NRC) staff reviews the applicant’s methodology separately following the guidance in Section 2.1. To verify that the applicant has properly implemented its methodology, the NRC staff focuses its review on the implementation results. Such a focus allows the NRC staff to confirm that there is no omission of electrical and I&C components that are subject to an AMR by the applicant. If the review identifies no omission, the NRC staff has the basis to find that there is reasonable assurance that the applicant has identified the electrical and I&C components that are subject to an AMR.

An applicant should list all plant-level systems and structures. On the basis of the design basis events (DBEs) considered in the plant’s current licensing basis (CLB) and other CLB information relating to nonsafety-related systems and structures and certain regulated events, the applicant would identify those plant-level systems and structures that are ~~WSLR~~within the scope of SLR, as defined in 10 CFR 54.4(a). This is “scoping” of the plant-level systems and structures for ~~license renewal.~~SLR. The NRC staff reviews the applicant’s plant-level “scoping” results separately following the guidance in Section 2.2.

For an electrical and I&C system that is ~~WSLR~~within the scope of SLR, an applicant may not identify the specific electrical and I&C components that are subject to an AMR. For example, an applicant may not “tag” each specific length of cable that is “passive” and “long-lived,” and performs an intended function as defined in 10 CFR 54.4(b). Instead, an applicant may use the so-called “plant spaces” approach (Ref. 1), which is explained below. The “plant spaces” approach provides efficiencies in the AMR 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 AMR, 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”) as subject to an AMR for ~~license renewal.~~SLR. In the subsequent AMR, the applicant would evaluate the environment of the turbine building to determine the appropriate aging management activities for this equipment. The applicant has options to further refine this encompassing scope on an as-needed basis. For this example, if the applicant identified elevated temperatures in a particular area within the turbine building, the applicant may elect to further refine the scope in this particular area by (1) identifying electrical equipment that is not subject to an AMR and (2) excluding this equipment from the AMR. In this case, the excluded electrical equipment would be reported in the application as not being subject to an AMR.

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 AMR for ~~license renewal.~~SLR. Therefore, the 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 AMR. However, the time-limited aging analysis (TLAA) evaluation requirements in 10 CFR 54.21(c) apply to environmental qualification of electrical equipment, which is not limited to “passive” components.

An applicant has the flexibility to determine the set of electrical and I&C components for which an AMR is performed, provided that this set includes the electrical and I&C components for which the NRC has determined an AMR is required. This is based on the statements of consideration for the License Renewal Rule (60 FR 22478). Therefore, the reviewer need not review all components that the applicant has identified as subject to an AMR because the applicant has the option to include more components than those required by 10 CFR 54.21(a)(1).

2.5.2. Acceptance Criteria

The acceptance criteria for the areas of review define methods for determining whether the applicant has met the requirements of NRC regulations in 10 CFR 54.21(a)(1). For the applicant’s implementation of its methodology to be acceptable, the NRC staff should have reasonable assurance that there has been no omission of electrical and I&C system components that are subject to an AMR.

2.5.2.1 Components Within the Scope of Subsequent License Renewal

Electrical and I&C components are ~~WSLR~~within the scope of SLR as delineated in 10 CFR 54.4(a) if they are

- Safety-related systems, structures, and components (SSCs) that are relied upon to remain functional during and following DBEs ~~(~~[as defined in 10 CFR 50.49(b)(1~~)~~)] to ensure the following functions:

  — The integrity of the reactor coolant pressure boundary;

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

  — 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), 10 CFR 50.67(b)(2) or 10 CFR 100.11, as applicable.

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

- All SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (PTS) (10 CFR 50.61), anticipated transients without scram (ATWS) (10 CFR 50.62), and station blackout (SBO) (10 CFR 50.63).

2.5.2.1.1 Components Within the Scope of SBO (10 CFR 50.63)

Both the offsite and onsite power systems are relied upon to meet the requirements of the SBO Rule. This includes the following:

- The onsite power system meeting the requirements under 10 CFR 54.4(a)(1) (safety~~-~~-related systems)

- Equipment that is required to cope with an SBO (e.g., alternate ac power sources) meeting the requirements under 10 CFR 54.4(a)(3)

- The plant system portion of the offsite power system that is used to connect the plant to the offsite power source meeting the requirements under 10 CFR 54.4(a)(3). The electrical distribution equipment out to the first circuit breaker with the offsite distribution system (i.e., equipment in the switchyard). This path typically includes the circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and transformer and onsite electrical distribution system, and the associated control circuits and structures. However, the NRC staff's review is based on the plant-specific ~~current licensing basis~~CLB, regulatory requirements, and offsite power design configurations.

2.5.2.2 Components Subject to an Aging Management Review

Electrical and I&C components are subject to an AMR if they are ~~WSLR~~within the scope of SLR 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 verifies the applicant’s scoping and screening results. If the reviewer requests additional information from the applicant regarding why a certain component was not identified by the applicant as being ~~WSLR~~within the scope of SLR or subject to an AMR for the applicant’s plant, the reviewer should provide a focused question that clearly explains what information is needed, why the information is needed, and how the information will allow the NRC staff to make its safety finding. In addition, other NRC staff members review the applicant’s scoping and screening methodology separately following the guidance in Section 2.1. The reviewer should keep these other NRC staff members informed of findings that may affect their review of the applicant’s methodology. The reviewer should coordinate this sharing of information through the ~~license renewal~~SLR project manager.

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

~~The scope~~Some of ~~10 CFR 50.49 electric~~the electrical equipment ~~to be included within 10 CFR 54.4(a)(3) is~~ that ~~"long-lived" (~~is in the scope of 10 CFR 50.49 that have a qualified life of 40 years or greater~~) equipment~~ are also within the scope of SLR under 10 CFR 54.4(a)(3). They have already been identified by ~~licensees~~licenses under 10 CFR 50.49(b~~), which specifies certain electric equipment important to safety.~~). Licensees may rely upon their listing of environmental qualification (EQ) equipment, as required by 10 CFR 50.49(d), for the purposes of identifying electrical equipment satisfying 10 CFR 54.4(a)(3) ~~with respect to equipment~~that is also 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 ~~environmental qualification~~EQ (10 CFR 50.49). ~~Environmental qualification~~ EQ equipment is not limited to "passive" equipment. The applicant may identify ~~environmental qualification~~EQ equipment separately for TLAA evaluation and not include such equipment as subject to an AMR under 10 CFR 54.21(a)(1). The ~~environmental qualification~~EQ equipment identified for TLAA evaluation would include the "passive" ~~environmental qualification~~EQ equipment subject to an AMR. The TLAA evaluation would ensure that the ~~environmental qualification~~EQ equipment would be functional for the period of extended operation. The NRC staff reviews the applicant's ~~environmental qualification~~EQ TLAA evaluation separately following the guidance in Section 4.4.

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

2.5.3.1 Components Within the Scope of Subsequent License Renewal

In this step, the NRC staff determines whether the applicant has properly identified the components that are ~~WSLR.~~within the scope of SLR. The Rule requires that the ~~LRA~~subsequent license renewal application (SLRA) identify and list components that are ~~WSLR~~within the scope of SLR and are subject to an AMR. Whereas, in the past, ~~LRAs~~SLRAs have included a table of components that are ~~WSLR~~within the scope of license renewal, generally that information need not be submitted with future ~~LRAs.~~SLRAs. Although that information will be available at plant sites for inspection, the reviewer must determine, through sampling of one-line diagrams and through review of the updated final safety analysis report (UFSAR) and other plant documents, what portion of the components are ~~WSLR.~~within the scope of SLR. The reviewer must check to see if any components exist that the NRC staff believes are within the scope but are not identified by the applicant as being subject to AMR (any request that the applicant provide justification for omitting those components that are "passive" and "long-lived").

The reviewer should use the UFSAR, orders, applicable regulations, exemptions, and license conditions to determine the design basis for the SSCs. The design basis specifies the intended function(s) of the system(s). That intended function is used to determine the components within that system that are required for the system to perform its intended functions.

The applicant may use the "plant spaces" approach in scoping electrical and I&C components for ~~license renewal.~~SLR. 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 ~~WSLR.~~within the scope of SLR. The applicant may also indicate that all electrical and I&C components located within another plant area ("plant space"), such as the warehouse, are not ~~WSLR.~~within the scope of SLR. Table 2.5-1 contains examples of this "plant spaces" approach and the corresponding review procedures.

The applicant would use the "plant spaces" approach for the subsequent AMR 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 equipment located there. The applicant has the option 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 AMR. This approach of limiting 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 may be ~~WSLR~~within the scope of SLR in these limited "plant spaces." The reviewer should verify that the electrical and I&C components that the applicant has elected to further exclude do not indeed have any intended functions as defined in 10 CFR 54.4(b).

Section 2.1 contains additional guidance on scoping the following:

- Commodity groups
- Complex assemblies
- Scoping events
- Hypothetical failure
- Cascading

If the reviewer does not identify any omissions of components from those that are ~~WSLR,~~within the scope of SLR, the NRC staff would have reasonable assurance that the applicant has identified the components ~~WSLR~~within the scope of SLR for the electrical and I&C systems.

2.5.3.2 ~~Component~~Components Subject to an Aging Management Review

In this step, the reviewer determines whether the applicant has properly identified the components subject to an AMR from among those which are ~~WSLR~~within the scope of SLR (i.e., those identified in Subsection 2.5.3.1). The reviewer should review selected components that the applicant has identified as being ~~WSLR~~within the scope of SLR to verify that the applicant has identified these components as being subject to an AMR 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 AMR. Table 2.1-5 lists many typical components and structures, and their associated intended functions, and identifies whether they are "passive." The reviewer should use Table 2.1-5 in identifying whether certain components are "passive." The reviewer should verify that electrical and I&C components identified as "passive" in Table 2.1-5 have been included by the applicant as being subject to an AMR. Although Table 2.1-5 is extensive, it may not be all-inclusive. Thus, the reviewer should use other available information sources, such as prior application reviews, to determine whether a component may be subject to an AMR.

Section 2.1 contains additional guidance on screening the following:

- Consumables
- Multiple intended functions

If the reviewer does not identify any omissions of components from those that are subject to an AMR, the NRC staff would have reasonable assurance that the applicant has identified the components subject to an AMR for the electrical and I&C systems.

2.5.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of the ~~SRP-LR~~Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants, then the NRC staff's evaluation ~~supports~~would support conclusions of the following type, to be included in the safety evaluation report~~:~~.

On the basis of its review, as discussed above, the NRC staff concludes that there is reasonable assurance that the applicant has appropriately identified the electrical and instrumentation and controls system components subject to an ~~aging management review~~AMR in accordance with 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 NRC regulations, the method described herein will be used by the NRC staff in its evaluation of conformance with NRC regulations.

2.5.6 References

1. SNL. SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants-Electrical Cable and Terminations~~,"~~." Albuquerque, New Mexico: 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 that all electrical and I&C components on site are ~~WSLR~~within the scope of SLR.	This is acceptable, and a ~~staff~~ review is not necessary because all electrical and I&C components are included without exception and would include those required by the rule.
An applicant indicates that all electrical and I&C components located in seven specific buildings (containment, auxiliary building, turbine building, etc.) are ~~WSLR~~within the scope of SLR.	The reviewer should review electrical systems and components in areas outside of these seven buildings ("plant spaces"). The reviewer should verify that the applicant has included any direct-buried cables in trenches between these buildings as ~~WSLR~~within the scope of SLR if they perform an intended function. The reviewer should also select buildings other than the seven indicated (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 onsite, except for the 525 kV switchyard, 230 kV transmission lines, radwaste facility, and 44 kV substation, are ~~WSLR.~~within the scope of SLR.	The reviewer should select the specifically excluded "plant spaces" (that is, the 525 kV switchyard, 230 kV transmission lines, radwaste facility, and 44 kV substation) to verify that they do not contain any electrical and I&C components that perform any intended functions.

3 AGING MANAGEMENT REVIEW

3.0 Integrated Plant Assessments and Aging Management Reviews

The U.S. Nuclear Regulatory Commission (NRC) Project Manager (PM) responsible for the safety review of the subsequent license renewal application (~~LRA~~SLRA) is responsible for assigning to appropriate NRC Office of Nuclear Reactor Regulation ~~(NRR)~~ divisions the review or audit of aging management reviews (AMRs) of systems, structures~~,~~ and components (SSCs) or aging management programs (AMPs) identified in the applicant's ~~LRA.~~SLRA. The PM documents to which organization each AMR or AMP is assigned. The assigned AMRs and AMPs are reviewed per the criteria described in Sections 3.1 through 3.6 of this Standard Review Plan ~~(SRP-LR, NUREG-1800)~~ for Review of ~~license renewal applications~~Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR), for review of SLRAs, as directed by the scope of each of these sections. Chapter 4 of this standard review plan provides guidelines for using time-limited aging analyses (TLAAs) as the basis for evaluating and managing aging effects by analysis. Specifically, Section 4.1 of this standard review plan (SRP) provides the NRC staff's guidance for identifying TLAAs in accordance with the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c)(1) and the definitions of TLAAs in 10 CFR 54.3. TLAAs are reviewed in accordance with the acceptance criteria and guidance described in Sections 4.2 through 4.7 of this SRP.

Review of the AMPs requires assessment of ~~ten~~10 program elements as defined in this SRP-~~LR.~~SLR. The NRC division assigned the AMP reviews the ~~ten~~10 program elements to verify their technical adequacy. For three of the ~~ten~~10 program elements (corrective actions, confirmation process, and administrative controls), the NRC division responsible for review of the quality assurance (QA) aspects of the application verifies that the applicant has documented a commitment in the Final Safety Analysis Report (FSAR) Supplement to expand the scope of its 10 CFR Part 50, Appendix B program to address the associated program elements for each AMP. If the applicant chooses alternate means of addressing these three program elements (i.e., use of a process other than the applicant's 10 CFR Part 50, Appendix B program~~),~~,) the NRC division assigned to review the AMP ~~requests~~should request that the division responsible for ~~quality assurance~~QA review the applicant's proposal on a case-specific basis. ~~Table 3.0-1 is a supplement to the FSAR and contains a list of programs that are applicable to each SRP-LR section and sub-section. It also contains the programs that are used to manage the aging effects associated with various systems.~~

Table 3.01 is a supplement to the FSAR and contains a list of programs that are applicable to each SRP-SLR and subsection. It also contains the programs that are applicable to managing the aging effects associated with various systems.

3.0.1 Background on the Types of Reviews

~~10 CFR~~ Section–54.21(a)(3) to 10 CFR Part 54 requires ~~that~~ -the ~~LRA~~application to demonstrate, for systems, structures, and components (SSCs) within the scope of license renewal and subject to an AMR pursuant to 10 CRF 54.21(a)(1), that the effects of aging are adequately managed so that the intended function(s) are maintained consistent with the current licensing basis (CLB) for the subsequent period of extended operation. This AMR consists of identifying the material, environment, aging effects, and the AMP(s) credited for managing the aging effects.

Sections 3.1 through 3.6 of this SRP-~~LR~~SLR describe how the AMRs and AMPs are reviewed. ~~One method that~~ In this SRP-SLR, Subsection 3.X.2 (where X denotes number 1–6) presents the acceptance criteria describing methods to determine whether the applicant ~~may~~ has met the requirements of the NRC's regulations in 10 CFR 54.21. Subsection 3.X.3 presents the review procedures to be followed.

The AMR line items in the 3.X-1 tables provide a generic list of AMRs for groups of components that may be included in the reactor coolant system, emergency safety feature systems, auxiliary systems, steam and power conversion systems, structures and structural components, and electrical systems of an applicant's pressurized water reactor (PWR) or boiling water reactor (BWR) plant design. The AMR items are provided in a column-based format that accomplishes the following objectives:

- New, Modified, Deleted Item: The description of this column identifies whether the AMR line item is new, was modified, or deleted. The NRC will publish the technical bases for these new, modified, and deleted AMR items in a NUREG containing the disposition of public comments and the technical bases for changes in the guidance documents when the final subsequent license renewal (SLR) guidance documents are published.
- "ID" column: The description for this column provides an identification number for the AMR item of a given commodity grouping of components that have common materials of fabrication, environmental conditions, and aging effects.
- "Type" column: The description for this column identifies whether the specific AMR item in the table is applicable to BWR or PWR plant designs.
- "Component" column: The description for this column identifies the specific components that are within the scope of the commodity grouping in the AMR item and the materials of fabrication and environmental conditions that are applicable to the components in the AMR item.
- "Aging Effect/Mechanism" column: The description for this column identifies the aging effects and mechanisms that are applicable to the material-environmental combinations for the components in the commodity grouping of the AMR item.
- "Aging Management Program/TLAA" column: The description for this column provides AMPs or TLAAs that may be used to manage the aging effects that apply to the components in the commodity grouping of the AMR item and to demonstrate compliance with the aging management requirement in 10 CFR54.21(a)(3).
- "Further Evaluation" column: The description for this column identifies whether the AMP or TLAA recommended in the "Aging Management Program/TLAA" column of the AMR item requires additional evaluation (further evaluation) by an applicant adopting the AMR item. This column also references specific subsection(s) in SRP-SLR Section 3.1.2.2 that applies to the evaluation of the components in the commodity grouping of the AMR item.
- "GALL-SLR Item" column: The description for this column identifies the component-specific AMR items in the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report that derives from the commodity-group-based item in the SRP-SLR AMR table.

The GALL-SLR Report is a technical basis document to the SRP-SLR and provides generic AMR and AMP guidance that may be used as part of the bases for developing an SLRA. As such, the GALL-SLR Report contains an acceptable method that may be used to assist an applicant in: (a) developing the integrated plant assessment (IPA) for an SLRA, as required by 10 CFR 54.21(a); (b) identifying those components and structures that are required to be within the scope of an AMR, as required by 10 CFR 54.21(a)(1); and (c) managing those aging effects that are applicable to these SSCs, as required by 10 CFR 54.21(a)(3). An applicant may propose an alternative method for performing the IPA. Therefore, the use ~~to conduct~~of the GALL-SLR Report is not required; however, its ~~AMRs is to satisfy the NUREG-1801 (GALL Report)~~use should facilitate both preparation of a SLRA by an applicant and timely, uniform review by the NRC staff. If the GALL-SLR report is used for the development of an SLRA, the GALL-SLR Report should be treated as an NRC-approved topical report.

The GALL-SLR Report contains an AMR evaluation of a large number of SCs that may be in the scope of a typical SLRA and may need to be the subject of an AMR in accordance with requirements in 10 CFR 54.21(a)(1). The AMR results documented in the GALL-SLR Report indicate that many existing, typical generic AMPs are adequate to manage aging effects for particular structures or components without change. The GALL-SLR Report also contains recommendations~~.~~ on specific areas for which generic existing programs should be augmented for SLRAs and documents the technical basis for each such determination. In addition, the GALL-SLR Report identifies certain SCs that may or may not be subject to particular aging effects, and for which industry groups are developing generic AMPs or investigating whether aging management is warranted. The ultimate generic resolution of such an issue may need NRC review and approval for plant-specific implementation, as indicated in a plant-specific FSAR supplement, and reflected in the safety evaluation report (SER) associated with a particular SLRA.

The GALL-SLR Report does not address scoping of SSCs for subsequent license renewal (SLR). The determination of SSCs that need to be within the scope of SLR is plant-specific aspect of the application and is required to be performed in accordance with the requirements in 10 CFR 54.4. Consistent with the scoping guidelines in Chapter 2 of this SRP-SLR Report, the scoping results for an SLRA are dependent on the plant design and CLB. Therefore, the inclusion of a certain structure or component in a given AMR line item of the GALL-SLR Report does not mean that this particular structure or component is within the scope of SLR for all plants.

Conversely, the omission of a certain structure or component in the GALL-SLR Report does not mean that a particular structure or component in the plant design is not within the scope of the SLRA or does not need to be the subject of an AMR in accordance with the requirements in 10 CFR 54.21(a)(1). The AMR line items in the SRP-SLR and GALL-SLR Report may not provide a comprehensive list of all structures of components that need to be within the subject of an AMR or a comprehensive list of all potential aging effects that may be applicable to those structures or components as being the subject of an AMR. Therefore, as has been the practice for initial license renewal applications (LRAs), plant-specific AMRs should be performed if additional aging effects (not referenced in the SRP-SLR and GALL-SLR reports) are applicable to the design of a specific structure or component subject to an AMR.

As indicated in the bulleted list above, the specific AMR line items in Chapters II–VIII of the GALL-SLR Report derive from and are identified in the AMR line items of the 3.X-2 tables of the SRP-SLR. The AMR line items in GALL-SLR Report are formatted in a manner that is analogous (but not identical) to the format of the AMR line items in the SRP-SLR. In addition, as indicated above, the "Further Evaluation" column in the AMR line items of the 3.X-1 tables of this report and the AMR tables (Chapters II through VIII of the GALL-SLR Report) establish whether the aging management bases in those AMR line items need to be the subject of further assessment by the applicant (i.e., the subject of "further evaluations"). The "further evaluation" topics and the acceptance criteria for satisfying these "further evaluations" are described in the 3.X.2.2 subsections of this report. The related review procedures for these "further evaluation" topics are provided in the 3.X.3.2 subsections of this report.

Therefore, for SCs in the plant design that are required to be scoped into the SLRA and subject to an AMR, the applicant may use the AMR line items in the 3.X-1 tables of the SRP-SLR, and the AMR line items in the GALL-SLR Report referenced in these SRP-SLR tables, as a basis for comparison to the design of the SCs in the plant design. If this method is used for development of the AMR, the applicant may adopt those AMR items in the SRP-SLR and GALL-SLR Reports that are applicable to the design of the SCs in the plant in order to aid the applicant in identifying those aging effects that are applicable to the structures or components. For those AMR items in the SLRA that are designated as being consistent with the SRP-SLR and GALL-SLR Reports and are the subject of "further evaluation" aging management topics, the AMR should include the applicant's bases on how those "further evaluation" criteria have been addressed and met, as applicable to the licensing basis and design basis for the plant's design.

As part of the development of the SLRA, the applicant should assess the AMPs in the GALL SLR Report. The applicant may choose to use ~~methodology other than~~an AMP that ~~in~~ is consistent with the GALL SLR Report ~~to demonstrate compliance with 10 CFR 54.21(~~AMP, or may choose a~~)(3).~~

~~The GALL Report is a technical basis document to the SRP-LR, which provides the staff with guidance in reviewing a license renewal application.~~ plant-specific AMP. An applicant may reference the GALL-SLR Report in ~~a license renewal application~~an SLRA to ~~demonstrate that the~~designate which programs at the applicant's facility will be used to manage the effects of aging for specific structures or components, and how those programs correspond to ~~those~~the AMPs reviewed and approved in the GALL-SLR Report. ~~The GALL Report (NUREG-1801) should be treated as an approved topical report. However,~~ If an applicant ~~takes~~does take credit for a program in the GALL-SLR Report, it is incumbent on the applicant to ensure that the conditions and operating experience at the plant is bounded by the conditions and operating experience for which the GALL-SLR Report program was evaluated. If these bounding conditions are not met it is incumbent on the applicant to address the additional effects of aging and augment the ~~aging management program~~AMP(s) in the GALL-SLR Report in the SLRA, as appropriate.

~~The staff will verify that the applicant's programs are consistent with those described in the GALL report and/or with plant conditions and operating experience during the performance of an aging management program audit and review. The focus of the balance of the staff review of a license renewal application is on those programs that an applicant has enhanced to be consistent with the GALL Report, those programs for which the applicant has taken an exception to the program described in the GALL Report, and plant-specific programs not described in the GALL Report.~~

~~If an applicant takes credit for a program in the GALL Report, it is incumbent on the applicant to ensure that the plant program contains all the elements of the referenced GALL Report program. In addition, the conditions at the plant must be bounded by the conditions for which the GALL Report program was evaluated. The above verifications must be documented onsite~~

~~in an auditable form. The applicant should include a certification in the license renewal application that the verifications have been completed and are documented onsite in an auditable form.~~

~~The GALL Report contains one acceptable way to manage aging effects for license renewal. An applicant may propose alternatives for staff review in its plant-specific license renewal application. Use of the GALL Report is not required, but its use should facilitate both preparation of a license renewal application by an applicant and timely, uniform review by the NRC staff.~~

~~In addition, the GALL Report does not address scoping of structures and components for license renewal. Scoping is plant-specific, and the results depend on the plant design and current licensing basis. The inclusion of a certain structure or component in the GALL Report does not mean that this particular structure or component is within the scope of license renewal for all plants. Conversely, the omission of a certain structure or component in the GALL Report does not mean that this particular structure or component is not within the scope of license renewal for any plants.~~

~~The GALL Report contains an evaluation of a large number of structures and components that may be in the scope of a typical LRA. The evaluation results documented in the GALL Report indicate that many existing, typical generic aging management programs are adequate to manage aging effects for particular structures or components for license renewal without change. The GALL Report also contains recommendations on specific areas for which generic existing programs should be augmented for license renewal and documents the technical basis for each such determination. In addition, the GALL Report identifies certain SSCs that may or may not be subject to particular aging effects, and for which industry groups are developing generic aging management programs or investigating whether aging management is warranted. To the extent that the ultimate generic resolution of such an issue will need NRC review and approval for plant-specific implementation, as indicated in a plant-specific FSAR supplement, and reflected in the SER associated with a particular LR application, an amendment pursuant to 10 CFR 50.90 will be necessary.~~

~~In this SRP-LR, subsection 3.X.2 (where X denotes number 1-6) presents the acceptance criteria describing methods to determine whether the applicant has met the requirements of NRC's regulations in 10 CFR 54.21. Subsection 3.X.3 presents the review procedures to be followed. Some rows (items) in the AMR tables (in Chapters II through VIII of the GALL Report) establish the need to perform "further evaluations." This can be clearly seen in Tables 3.X-1, and the last two columns (for 2010 and 2005, respectively) denoted the Rev2 and Rev1 AMR Line Item references. The acceptance criteria for satisfying these "further evaluations" are found in Subsections 3.X.2.2. The related review procedures are provided in subsections 3.X.3.2.~~

~~In Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," the NRC has endorsed an acceptable methodology for applicants to structure license renewal applications. Using the guidance described in the aforementioned Regulatory Guide, the applicant documents in the LRA whether its AMR item is consistent or not consistent with the GALL Report.~~

~~A portion of the AMR includes the assessment of the AMPs in the GALL Report. The applicant may choose to use an AMP that is consistent with the GALL Report AMP, or may choose a plant-specific AMP.~~

~~If a GALL~~If a GALL-SLR Report AMP is selected to manage aging, the applicant may take one or more exceptions to specific GALL-SLR Report AMP program elements. However, any deviation or exception to the GALL-SLR Report AMP should be described and justified. ~~Exceptions~~ Exceptions are portions of the GALL-SLR Report AMP that the applicant does not intend to implement.

In some cases, an applicant may choose an existing plant program that does not currently meet all the program elements defined in the GALL-SLR Report AMP. If this is the situation, the applicant makes a commitment to augment the existing program to satisfy the GALL-SLR Report AMP elements prior to the subsequent period of extended operation.~~ This commitment is an AMP "enhancement."~~

Enhancements are revisions or additions to existing ~~aging management programs~~ AMPs that the applicant commits to implement prior to the subsequent period of extended operation. Enhancements include, but are not limited to, those activities needed to ensure consistency with the GALL-SLR Report recommendations. Enhancements may expand, but not reduce, the scope of an AMP.

For the programs submitted in the SLRA that the applicant claims are consistent with the GALL-SLR, the NRC staff will verify that the applicant's programs are consistent with those described in the GALL-SLR Report and/or with plant conditions and operating experience during the performance of an AMP audit and review. The focus of the balance of the NRC staff review of a SLRA is on those programs that an applicant has enhanced to be consistent with the GALL-SLR Report, those programs for which the applicant has taken an exception to the program described in the GALL-SLR Report, and plant-specific programs not described in the GALL-SLR Report.

An audit and review is conducted at the applicant's facility to evaluate AMPs that the applicant claims to be consistent with the GALL~~ Report. Reviews are~~-SLR Report. The applicant may use a plant-specific AMP or plant-specific aging management activities as the basis for aging management of a specific structure or component. If plant-specific AMPs or aging management activities are used as the basis for aging management, the NRC staff reviews the AMPs or activities in accordance with the program element criteria that are defined in the SRP-SLR Appendix A.1, Subsection A.1.2.3.

Reviews are also performed to address those AMRs or AMPs related to emergent issues, stated to be not consistent with the GALL-SLR Report, or based on an NRC-approved precedent (e.g., AMRs and AMPs addressed in an NRC SER of a previous ~~LRA).~~SLRA) or technical or topical report. SRP-SLR Section 3.0.3 provides additional guidance on reviewing those GALL-based or plant-specific AMPs that are based on NRC-endorsed technical or topical reports. As a result of the criteria established in 10 CFR Part 54, the guidance provided in SRP~~-LR~~-SLR, GALL-SLR Report, ~~Regulatory Guide 1.188,~~ and the applicant's exceptions and/or enhancements to a GALL-SLR Report AMP, the following types of AMRs and AMPs are audited or reviewed by the NRC staff.

AMRs

- AMR results consistent with the GALL-SLR Report
- AMR results for which further evaluation is recommended ~~by the GALL Report~~
- AMR results not consistent with or not addressed in the GALL-SLR Report

AMPs

- Consistent with the GALL~~-~~SLR Report AMPs
- Plant-specific AMPs

FSAR Supplement

- Each ~~LRA~~SLRA AMP will provide an FSAR Supplement which defines changes to the FSAR that will be made as a condition of a renewed license. This FSAR Supplement defines the ~~aging management programs~~AMPs the applicant is crediting to satisfy 10 CFR 54.21(a)(3).

- The FSAR Supplement should also contain a commitment to implement the ~~LRA~~SLRA AMP enhancement prior to the subsequent period of extended operation.

3.0.2 Applications With Approved Extended Power Uprates

Extended power uprates (~~EPU~~EPUs) are licensing actions that some licensees have recently requested the NRC staff to approve. This can affect aging management. In an NRC staff letter to the Advisory Committee on Reactor Safeguards, dated October 26, 2004 (ADAMS Accession No. ML042790085), the NRC Executive Director for Operation states that "All license renewal applications with an approved EPU will be required to perform an operating experience review and its impact on ~~[aging] management programs~~AMPs for ~~structures, and components~~SCs before entering the subsequent period of extended operation." One way for an applicant with an approved EPU to satisfy this criterion is to document its commitment to ~~performing~~perform an operating experience review and its impact on ~~aging management programs~~AMPs for ~~systems, structures, and components (~~SSCs~~)~~ before entering the subsequent period of extended operation as part of its ~~license renewal application.~~SLRA. Such licensee commitments should be documented in the NRC staff's SER, written in support of issuing a renewed license. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant completes these activities no later than the committed date. EPU impact on SSCs should be part of the ~~license renewal~~SLR review. If necessary, the PM assigns a responsible group to address EPU.

~~NOTE: In the Summary of Aging Management review tables, the Component field provides a description of the component, material, and environment combinations for which the GALL Report recommends a specified aging management program to manage the related aging effect/mechanism. To provide SRP-LR tables in a format most useful to the reviewer and industry, the presentation and specific language describing structure/components, materials, aging effects/mechanisms, and supplemental information supporting the aging management programs may vary somewhat between chapters. Tables 3.3-1, 3.4-1, and 3.6-1 exhibit similar language while Tables 3.1-1 and 3.5-1 exhibit language that varies somewhat. Also note that the capitalization and punctuation scheme in these Tables 3.X-1 can seem variable, the SRP-LR component column is an artifact of how material and component information has been consolidated in this report. This is not a technical difference, but one that supports the presentation of the materials in the desired table format. When in doubt, refer back to the specified "Rev2 Item," the AMR Item(s) upon which a given row is based.~~

3.0.3 Aging Management Programs that Rely on Implementation of Nuclear Regulatory Commission-Approved Technical or Topical Reports

The U.S. Nuclear Regulatory Commission (NRC) Office Instruction LIC-500, Revision 5, establishes the NRC's current process expectations for applying the methodology in an NRC-endorsed or NRC-approved technical report or topical report (TR) to the CLB or current design basis of a licensed U.S. light-water reactor facility. The LIC-500 office instruction identifies that use of such reports may be subject to specific limitations or actions, which are identified and issued in the NRC's safety evaluations (SEs) that are issued regarding on the TR methodologies. The LIC-500 office instruction states that it is the NRC's expectation that licensees or applicants applying these types of reports to their CLBs or design bases will address or respond to those action items or limitations that were issued in the NRC staff's SEs regarding the TR methodologies.

Generic Aging Lessons Learned for Subsequent License Renewal Report(GALL-SLR) aging management programs (AMPs) that rely on the recommended activities in NRC-endorsed TRs identify those TRs that are within the scope of the AMPs. Examples of GALL-SLR AMPs that rely on NRC-approved industry reports include, but are not limited to, (1) GALL-SLR Report AMP XI.M4, "BWR ID Attachment Welds," (2) GALL-SLR Report AMP XI.M5, "BWR Feedwater Nozzles," (3) GALL-SLR Report AMP XI.M8, "BWR Penetrations," and (4) GALL-SLR Report AMP XI.M9, "BWR Vessel Internals." Plant-specific AMPs may also be based on NRC-approved TRs.

For AMPs that rely on one or more NRC-endorsed TRs, the use of TR methodologies that are relied upon for aging management is subject to the applicant's bases for resolving any limitations or action items that are placed on implementation of the applicable TR methodologies. Therefore, an applicant's bases for resolving any limitations or actions items on the TRs is especially relevant to the applicant's determination on whether the scope of the program, or other program elements in the AMP, will need to be augmented or enhanced beyond conformance with the recommended criteria, evaluations, and activities in the applicable TRs. Therefore, the AMPs should include the applicant's bases for resolving any limitation or action items on the applicable TR methodologies, as documented in the NRC SE regarding the methodologies. If it is determined that the basis for resolving a specific TR limitation or applicant action item would result in the need for augmentation of the AMP beyond the criteria, evaluations, or activities recommended in the TRs, the applicant should enhance its AMPs accordingly to identify the TR guidance protocols or activities that will be impacted and the specific AMP program elements that will need to be enhanced or adjusted (as necessary and applicable to the CLB and design basis for the facility) as a result of the applicant's basis for resolving the specific limitation or action item. Consistent with the recommendations in NEI 95-10, applicants may provide their bases for resolving the specific limitations or action items in Appendix C of their SLRAs.

In addition, for AMPs that rely on these types of TRs, the recommended activities in these TRs may go beyond those activities that are within the scope of applicable NRC requirements (e.g., those requirements in any of the applicable Federal Acts, NRC regulations, plant operating license or technical specification requirements, or NRC-issued orders). Implementation of the TRs referenced in the AMPs does not relieve the applicant from complying with the applicable requirements, unless applicable Code reliefs, regulatory exemptions, or notices of enforcement action are requested and granted by the NRC for the specific type of requirement that applies to the CLB. This is in addition to those aspects of the 10 CFR Part 50, Appendix B program that may apply to the AMPs.

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
XI.E1	Electrical Insulation ~~Material~~ for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	The program ~~consists~~provides reasonable assurance that the intended functions of electrical cable insulating material (e.g., power, control, and instrumentation) and connection insulating material that are not subject to the environmental qualification requirements of 10 CFR 50.49 are maintained consistent with the current licensing basis through the subsequent period of extended operation. The program is a cable and connection insulation material condition monitoring program that utilizes sampling. The component sampling methodology utilizes a population that includes a representative sample of in-scope electrical cable and connection types regardless of whether or not the component was included in a previous aging management or maintenance program. The technical basis for the sample selection is documented. The program applies to accessible electrical cable and connection electrical insulation material within the scope of license renewal including in-scope cables and connections ~~installed in~~subjected to an adverse localized ~~environments to be~~ environment. Accessible in-scope electrical cable and connection electrical insulation material is visually inspected ~~at least once every 10 years~~and tested for cable ~~jacket~~ and connection insulation surface anomalies~~, such~~ indicating signs of reduced electrical insulation resistance. Visual Inspection and testing may include thermography and one or more proven condition monitoring test methods applicable to the cable and connection insulation material. Electrical cable and connection insulation material test results are to be within the acceptance criteria, as ~~embrittlement, discoloration, cracking, melting, swelling, or~~ identified in the applicant's procedures. Visual inspection results show that	First inspection for license renewal completed prior to the subsequent period of extended operation	GALL VI / SRP 3.6

Table 3.0-1.	**FSAR Supplement for Aging Management of Applicable Systems for SLR**			
~~GALL Chapter~~ AMP	**GALL-SLR Program**	**Description of Program**	**Implementation Schedule***	**Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References**
		accessible cable and connection insulation material are free from visual indications of surface ~~contamination,~~abnormalities that ~~could~~ indicate ~~incipient conductor insulation aging degradation from temperature, radiation, or moisture.~~cable or connection electrical insulation aging effects exist. When acceptance criteria are not met, a determination is made as to whether the surveillance, inspection, or tests, including frequency intervals, need to be modified. The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research and development (e.g., test methods, aging models, acceptance criterion) such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.[The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
XI.E2	Electrical Insulation ~~Material~~ for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	The program ~~calls for the review of calibration results or findings of surveillance tests on~~ applies to electrical cables and connections (cable system) electrical insulation material used in circuits with sensitive, high ~~-~~voltage, low-level current signals~~, such as~~. Examples of these circuits include radiation monitoring and nuclear instrumentation~~, to provide an indication of~~ that are subject to aging management review and subjected to adverse localized environments caused by temperature, radiation, or moisture. The program evaluates electrical insulation material for cable and connection subjected to an adverse localized environment. In addition to the evaluation and identification of adverse localized environments, either of two methods can	First review of calibration results or findings of surveillance test results or cable tests for license renewal completed prior to the subsequent period of extended operation	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		be used to identify the existence of ~~aging effects based on acceptance criteria related to instrumentation circuit performance.~~cable and connection insulation material aging degradation. In the first method, calibration results or findings of surveillance testing programs are evaluated to identify the existence of electrical cable and connection insulation material aging degradation. In the second method, direct testing of the cable system is performed. By reviewing the results obtained during normal calibration or surveillance, an applicant may detect severe aging degradation prior to the loss of the cable and connection intended function. The review of calibration results or findings of surveillance tests is performed at least once every 10 years. The test frequency of the cable system is determined by the applicant based on engineering evaluation, but the test frequency is at least once every 10 years. In cases where cables are not included as part of calibration or surveillance program testing circuit, a proven cable test ~~(such as insulation resistance tests, time domain reflectometry tests, or other testing judged~~ shown to be effective in determining cable system electrical insulation condition as justified in the ~~application)~~applicant's aging management program is performed. The first reviews and tests are completed prior to the subsequent period of extended operation. The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		and development (e.g., test ~~frequency is based on engineering evaluation and~~ methods, aging models, acceptance criterion) such that the effectiveness of the AMP is ~~at least once every 10 years.~~evaluated consistent with the discussion in Appendix B of the GALL-SLR Report. [The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
XI.~~E3~~E3A	Electrical Insulation for Inaccessible Medium Voltage Power Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	The program ~~calls for~~applies to inaccessible or underground (e.g~~.~~., installed in ~~conduit~~buried conduits, cable trenches, cable troughs, duct ~~bank~~banks, underground vaults, or direct buried~~)~~ installations) medium voltage power ~~(greater than or equal to 400 volts) cables~~cable (operating voltage; 2.3kV to 35kv) within the scope of license renewal exposed to adverse localized environments due primarily to significant moisture~~, to be tested at least once every 6 years to provide an indication of the condition of the conductor insulation. The specific type of test to be used should be capable of detecting reduced insulation resistance~~. An adverse localized environment is based on the most limiting environment (e.g., temperature, radiation, or moisture) for the cable electrical insulation. Significant moisture is considered an adverse localized environment for these in scope inaccessible cables. The cables included in this program are not subject to the environmental qualification requirements of 10 CFR 50.49.	First tests or first inspections for subsequent license renewal completed prior to the subsequent period of extended operation	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		Electrical insulation subjected to an adverse localized environment could increase the rate of aging of a component and therefore have an adverse effect on operability, or potentially lead to failure of the cable's insulation system ~~due to wetting or submergence. The applicant can assess the condition of the cable insulation with reasonable confidence using one or more of the following techniques: Dielectric Loss (Dissipation Factor/Power Factor), AC Voltage Withstand, Partial Discharge, Step Voltage, Time Domain Reflectometry, Insulation Resistance and Polarization Index, Line Resonance Analysis, or other testing that is state-of-the-art at the time the tests~~ . Although a condition monitoring program, periodic inspections are performed~~. One or more tests are used to determine the condition of the cables so they will continue~~ to ~~meet their intended function during the period of extended operation.~~ ~~The inspection frequency for water collection is established and performed based on plant-specific operating experience with cable wetting or submergence in manholes (i.e., the inspection is~~prevent inaccessible cable from being exposed to significant moisture. These inspections are performed periodically based on water accumulation over time ~~and event driven occurrences such as heavy rain or flooding).~~. The periodic inspection ~~should occur~~occurs at least annually~~. The inspection should~~ with the first inspection for subsequent license renewal completed prior to the subsequent period of extended operation. Inspections are performed after		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		event driven occurrences, such as heavy rain, thawing of ice and snow, or flooding. Both the periodic and event driven inspections include direct ~~observation~~indication that cables are not wetted or submerged, and that ~~cables~~cable/splices and cable support structures are intact, ~~and dewatering/drainage~~ Dewatering systems (~~i.~~e.g., sump pumps and drains) and associated alarms ~~operate properly. In addition, operation of dewatering devices should be~~are inspected and their operation verified ~~prior to any known~~. Inspections include documentation that either automatic or passive drainage systems, or manually pumping manholes and vaults is effective in preventing inaccessible cable submergence. Test frequencies are adjusted based on test results (including trending of degradation where applicable) and plant specific operating experience. The first tests for subsequent license renewal are to be completed prior to the subsequent period of extended operation with tests performed at least every 6 years thereafter. The specific type of test performed is determined prior to the initial test, and is to be a proven test for detecting deterioration of the cable insulation system (e.g., one or more tests may be required depending to the specific cable construction: shielded and non-shielded, and the insulation material under test). Tests may include combinations of situ or laboratory; electrical, physical, or ~~predicted heavy rain~~chemical testing. Testing may include inspection and testing of		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		cable subjected to the same environment (e.g., the use of coupons – abandoned or ~~flooding events.~~ removed cable). A plant specific inaccessible medium voltage test matrix is developed to document inspections, test methods, and acceptance criteria applicable to the applicant's in-scope inaccessible medium voltage power cable types. [The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
XI.E3B	Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	The program applies to inaccessible or underground (e.g., installed in buried conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations) instrument and control cable, within the scope of license renewal exposed to adverse localized environments due primarily to significant moisture. An adverse localized environment is based on the most limiting environment (e.g., temperature, radiation, or moisture) for the cable electrical insulation. Significant moisture is considered an adverse localized environment for these in scope inaccessible cables. The cables included in this program are not subject to the environmental qualification requirements of 10 CFR 50.49. Electrical insulation subjected to an adverse localized environment could increase the rate of aging of a component and therefore have an adverse effect on operability, or potentially lead to failure of the cable's insulation system.	First tests or first inspections for subsequent cense renewal completed prior to the subsequent period of extended operation	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		In scope inaccessible instrument and control cables submarine or other cables designed for continuous wetting or submergence are also included in this program as a onetime inspection with additional test and inspection frequencies determined by the onetime test, inspection results, and plant specific operating history. Although a condition monitoring program, periodic inspections are performed to prevent inaccessible cable from being exposed to significant moisture. These inspections are performed periodically based on water accumulation over time. The periodic inspection occurs at least annually with the first inspection for subsequent license renewal completed prior to the subsequent period of extended operation. Inspections are performed after event driven occurrences, such as heavy rain, thawing of ice and snow, or flooding. Both the periodic and event driven inspections include direct indication that cables are not wetted or submerged, and that cable/splices and cable support structures are intact, Dewatering systems (e.g., sump pumps and drains) and associated alarms are inspected and their operation verified. Inspections include documentation that either automatic or passive drainage systems, or manually pumping manholes and vaults is effective in preventing inaccessible cable submergence. Test frequencies are adjusted based on test results (including trending of degradation where applicable) and plant specific operating experience. The first tests for subsequent license renewal are to be		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		completed prior to the subsequent period of extended operation with tests performed at least every 6 years thereafter. The specific type of test performed is determined prior to the initial test, and is to be a proven test for detecting deterioration of the cable insulation system (e.g., one or more tests may be required depending to the specific cable construction: shielded and non-shielded, and the insulation material under test). Tests may include combinations of situ or laboratory; electrical, physical, or chemical testing. Testing may include inspection and testing of cable subjected to the same environment (e.g., the use of coupons – abandoned or removed cable). For a large installed number of inaccessible instrumentation and control cables, a sample test methodology may be employed. A plant specific inaccessible instrument and control cables voltage test matrix is developed to document inspections, test methods, and acceptance criteria applicable to the applicant's in-scope inaccessible instrument and control cable types.		
XI.E3C	Electrical Insulation for Inaccessible Low Voltage Power Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	The program applies to inaccessible or underground (e.g., installed in buried conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations) low voltage power cable (operating voltage; 1000v – but less than 2kV) within the scope of license renewal exposed to adverse localized environments due primarily to significant moisture. An adverse localized environment is based on the most limiting environment (e.g., temperature, radiation, or moisture) for the cable electrical insulation. Significant moisture is considered an adverse localized environment for	First tests or first inspections for license renewal completed prior to the subsequent period of extended operation	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		these in scope inaccessible cables. The cables included in this program are not subject to the environmental qualification requirements of 10 CFR 50.49. Electrical insulation subjected to an adverse localized environment could increase the rate of aging of a component and therefore have an adverse effect on operability, or potentially lead to failure of the cable's insulation system. In-scope inaccessible low voltage power cable splices subjected to wetting or submergence are also included within the scope of this program. In scope inaccessible low voltage submarine or other cables designed for continuous wetting or submergence are also included in this program as a onetime inspection with additional test and inspection frequencies determined by the onetime test, inspection results, and plant specific operating history. Although a condition monitoring program, periodic inspections are performed to prevent inaccessible cable from being exposed to significant moisture. These inspections are performed periodically based on water accumulation over time. The periodic inspection occurs at least annually with the first inspection for subsequent license renewal completed prior to the subsequent period of extended operation. Inspections are performed after event driven occurrences, such as heavy rain, thawing of ice and snow, or flooding. Both the periodic and event driven inspections include direct indication that cables are not wetted or submerged, and that cable/splices and cable support structures are intact, Dewatering systems (e.g., sump pumps and drains) and associated alarms are inspected and their operation verified. Inspections include documentation that either automatic or passive drainage systems, or manually pumping manholes		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		and vaults is effective in preventing inaccessible cable submergence. Test frequencies are adjusted based on test results (including trending of degradation where applicable) and plant specific operating experience. The first tests for subsequent license renewal are to be completed prior to the subsequent period of extended operation with tests performed at least every 6 years thereafter. The specific type of test performed is determined prior to the initial test, and is to be a proven test for detecting deterioration of the cable insulation system (e.g., one or more tests may be required depending to the specific cable construction: shielded and non-shielded, and the insulation material under test). Tests may include combinations of situ or laboratory; electrical, physical, or chemical testing. Testing may include inspection and testing of cable subjected to the same environment (e.g., the use of coupons – abandoned or removed cable). For a large installed number of inaccessible low voltage power cables, a sample test methodology may be employed. A plant specific inaccessible low voltage test matrix is developed to document inspections, test methods, and acceptance criteria applicable to the applicant's in-scope inaccessible low voltage power cable types.		
XI.E4	Metal Enclosed Bus	The program ~~calls for~~requires the visual inspection of metal enclosed bus (MEB) internal surfaces to detect age- related degradation, including cracks, corrosion, foreign debris, excessive dust buildup, and evidence of moisture intrusion. MEB insulating material is visually inspected for signs of embrittlement, cracking, chipping, melting, swelling, discoloration, or surface contamination, which may indicate overheating or aging degradation. The internal bus insulating supports are visually inspected for structural integrity and	First inspection for subsequent license renewal completed prior to the subsequent period of extended operation	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		signs of cracks. MEB external surfaces are visually inspected for loss of material due to general, pitting, and crevice corrosion. Accessible elastomers (e.g., gaskets, boots, and sealants) are inspected for degradation, including surface cracking, crazing, scuffing, and changes in dimensions (e.g., “ballooning” and “necking”), shrinkage, discoloration, hardening and loss of strength. ~~A sample of accessible~~ Bolted connections ~~is~~are inspected for increased resistance of connection by using thermography or by measuring connection resistance using a micro-ohmmeter. ~~These inspections are performed at least once every 10 years.~~ When thermography is employed by the applicant, the applicant demonstrates with a documented evaluation that thermography is effective in identifying MEB increased resistance of connection (e.g., infrared viewing windows installed, or demonstrated test equipment capability). The first inspection using thermography or measuring connection resistance is completed prior to the subsequent period of extended operation and at least every 10 years thereafter. As an alternative to thermography or measuring connection resistance of accessible bolted connections covered with heat shrink tape, sleeving, insulating boots, etc., the applicant may use visual inspection of the electrical insulation ~~material~~ to detect surface anomalies, such as embrittlement, cracking, chipping, melting, discoloration, swelling, or surface contamination. When ~~this~~ alternative visual inspection is used to check MEB bolted connections, the first inspection is completed prior to the subsequent period of extended operation and every 5 years thereafter.		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		Cable bus is a variation on MEB with similar in construction to an MEB, but instead of segregated or non-segregated electrical buses, cable bus is comprised of a fully enclosed metal enclosure that utilizes three-phase insulated power cables installed on insulated support blocks. Cable bus may omit the top cover or use a louvered top cover and enclosure. Both cable bus enclosures are not sealed against the intrusion of dust, industrial pollution, moisture, rain, or ice and therefore may be allow debris into the internal cable bus assembly. Cable bus construction and arrangement are such that it does not readily fall under a specific GALL Report AMP (e.g., GALL-SLR Report AMP XI.E4 or GALL-SLR Report AMP XI.E1). Therefore, cable bus is evaluated as a plant specific aging management program with a plant specific further evaluation. The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research and development (e.g., test methods, aging models, acceptance criterion) such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report. [The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
XI.E5	Fuse Holders	The program ~~consists~~was developed to specifically address aging management of fuse holder insulation material and fuse holder metallic clamp aging mechanisms and effects. In scope fuse holders located inside an active device (e.g., switchgear, power supplies, power inverters, control boards,	First tests for subsequent license renewal completed prior to the subsequent	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		battery chargers) and subject to fatigue caused by frequent fuse removal and replacement (e.g., surveillance, functional testing, and calibration) are also within the scope of this AMP. The scope of GALL-SLR Report AMP XI.E1, "Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," includes cable and connection electrical insulation material but not the metallic portion of cables and connections. This AMP inspects both the fuse holder electrical insulation material and the metallic portion of the fuse holder (metallic clamps). The program utilizes visual inspection and testing to identify age-related degradation for both fuse holder electrical insulation material and fuse holder metallic clamps. The specific type of test performed is determined prior to the initial test and is to be a proven test for detecting increased resistance of connection of fuse holder metallic clamps, or other appropriate testing justified in the applicant's aging management program. Fuse holders within the scope of license renewal ~~to be~~are visually inspected and tested at least once every 10 years to provide an indication of the condition of the ~~metallic clamp portion of the fuse holders. Testing may include thermography, contact resistance testing, or other appropriate testing~~ fuse holder. The first visual inspections and tests for license renewal are to be completed prior to the subsequent period of extended operation. When acceptance criteria are not met, a determination is made as to whether the inspections, or tests, including frequency intervals, need to be modified.	period of extended operation	

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		This program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research and development (e.g., test methods~~.~~, aging models, acceptance criterion) such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report. [The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
XI.E6	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	~~The program consists of a representative sample of electrical connections within the scope of license renewal, which is tested at least once prior to the period of extended operation to confirm that there are no aging effects requiring management during that period. Testing may include thermography, contact resistance testing, or other appropriate testing methods without removing the connection insulation, such as heat shrink tape, sleeving, insulating boots, etc. The one-time test provides additional confirmation to support industry operating experience that shows that electrical connections have not experienced a high degree of failures and that existing installation and maintenance practices are effective.~~ The program provides reasonable assurance that the metallic parts of electrical cable connections that are not subject to the environmental qualification requirements of 10 CFR 50.49 and susceptible to age-related degradation resulting in increased resistance of the connection are adequately managed. External cable connections associated with in-scope cables that terminate at active or passive devices are in the scope of this AMP. Wiring connections internal to an	First tests for subsequent license renewal completed prior to the subsequent period of extended operation	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		active assembly are considered part of the active assembly and, therefore, are not within the scope of this AMP. The cable connections covered under the Environmental Qualification (EQ) program are not included in the scope of this program. This AMP does not include high-voltage (>35 kilovolts) switchyard connections. This program is a sampling program. The following factors are considered for sampling: voltage level (medium and low voltage), circuit loading (high loading), connection type, and location (high temperature, high humidity, vibration, etc.). Twenty percent of a connector type population with a maximum sample of 25 constitutes a representative connector sample size. Otherwise a technical justification of the methodology and sample size used for selecting components under test should be included as part of the applicant's AMP documentation. The specific type of test to be performed is a proven test for detecting increased resistance of connection. As an alternative to thermography or ~~measuring connection~~ resistance measurement of ~~the~~ cable ~~connection sample,~~connections for the accessible cable connections that are covered with ~~heat shrink~~electrical insulation materials such as tape, ~~sleeving, insulating boots, etc.,~~ the applicant may ~~use~~perform visual inspection of the electrical insulation ~~materials~~material to detect ~~surface anomalies, such as embrittlement, cracking, chipping, melting, discoloration, swelling, or surface contamination. When this alternative~~aging effects for covered cable connections. The basis for performing only a periodic visual inspection is ~~used to check cable connections, the first~~ documented.		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		A representative sample of electrical connections within the scope of license renewal will be tested at least once every 10 years or at least once every 5 years if only visual inspection is used to provide an indication of the connection integrity. The first visual inspections and tests for license renewal are to be completed prior to the subsequent period of extended operation. This program is informed and ~~every 5 years thereafter.~~enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research and development (e.g., test methods, aging models, acceptance criterion) such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report. [The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
XI.E7	High Voltage Insulators New AMP	The program was developed specifically to address aging management of high voltage insulator aging mechanisms and effects. This AMP manages the age related degradation effects of within scope high voltage insulators susceptible to airborne contaminates including dust, salt, fog, cooling tower plume, industrial effluent or loss of material. The high voltage insulators within the scope of the subsequent period of extended operation are those credited for recovery of offsite power. This program includes visual inspections to identify insulation and metallic component degradation. High voltage insulator surfaces are visually inspected to detect reduced insulation resistance aging effects including cracks, foreign debris, and	New AMP	GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		excessive salt, dust, cooling tower plume and industrial effluent contamination. Metallic parts of the insulator are visually inspected to detect loss of material due to mechanical wear or corrosion. The high-voltage insulators within the scope of this program are to be visually inspected at least twice per year. For high voltage insulators that are coated, the visual inspection is performed at least once every 5 years. The first inspections for the subsequent period of extended operation are to be completed prior to the subsequent period of extended operation. This program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research and development (e.g., test methods, aging models, acceptance criterion) such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report. [The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	The program consists of periodic volumetric, surface, and/or visual examination of American Society of Mechanical Engineers (ASME) Class 1, 2, and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting for assessment, signs of degradation, and corrective actions. This program is in accordance with the ASME Code Section XI edition and addenda approved in accordance with	~~Existing program~~ SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL VII / SRP 3.3

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		provisions of 10 CFR 50.55a during the period of extended operation.		
XI.M2	Water Chemistry	This program mitigates aging effects of loss of material due to corrosion, cracking due to stress corrosion cracking (SCC~~)~~), and related mechanisms, and reduction of heat transfer due to fouling in components exposed to a treated water environment. Chemistry programs are used to control water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limits, based on Electric Power Research Institute (EPRI) guidelines (a) BWRVIP-190 (EPRI 1016579, BWR Water Chemistry Guidelines – 2008 Revision) for BWRs or (b) EPRI 1014986 (PWR Primary Water Chemistry – Revision 6) and EPRI 1016555 (PWR Secondary Water Chemistry – Revision 7) for pressurized water reactors (PWRs).	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 ~~GALL V / SRP 3.2~~ ~~GALL VII / SRP 3.3~~ ~~GALL VIII / SRP 3.4~~ ~~GALL III / SRP 3.5~~
XI.M3	Reactor Head Closure Stud Bolting	~~This~~The program includes (a) in-service inspection (ISI) in conformance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1, and (b) preventive measures to mitigate cracking. The program also relies on recommendations to address reactor head stud bolting degradation as delineated in ~~NUREG-1339 and~~ NRC Regulatory Guide (RG) 1.65~~.~~, Revision 1.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1
XI.M4	BWR Vessel ID Attachment Welds	~~The program includes (a) inspection and flaw evaluation in conformance with the guidelines of staff-approved BWRVIP-48-A to ensure the long-term integrity and safe operation of boiling water reactor (BWR) vessel internal components.~~The program is a condition monitoring program	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		that manages cracking in the reactor vessel inside diameter attachment welds. This program relies on visual examinations to detect cracking. The examination scope, frequencies, and methods are in accordance with ASME Code, Section XI, Table-IWB-2500-1, Examination Category B-N-2, and BWRVIP-48-A, “Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines,” dated November 2004. The scope of the examinations is expanded when flaws are detected. Any indications are evaluated in accordance with ASME Code, Section XI, or the guidance in BWRVIP 48-A. Crack growth evaluations follow the guidance in BWRVIP-14-A, “Evaluation of Crack Growth in BWR Stainless Steel RPV Internals, dated September 2008; BWRVIP-59-A, “Evaluation of Crack Growth in BWR Nickel-Base Austenitic Alloys in RPV Internals,” dated May 2007; or BWRVIP-60-A, “BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Low Alloy Steel RPV Internals,” dated June 2003; as appropriate. The acceptance criteria are in BWRVIP-48-A and ASME Code, Section XI, Subsubarticle IWB-3520. Repair and replacement activities are conducted in accordance with BWRVIP-52-A, “Shroud Support and Vessel Bracket Repair Design Criteria,” dated September 2005.		
XI.M5	BWR Feedwater Nozzle	~~This program includes (a) enhancing ISI specified in the ASME Code, Section XI, with the recommendation of General Electric (GE) NE-523-A71-0594 to perform periodic ultrasonic testing inspection of critical regions of the BWR feedwater nozzle.~~ *Description for plants that do not have single sleeve interference fit feedwater spargers:* This program is a condition monitoring program that manages the effects of cracking in the reactor vessel feedwater	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		nozzles. This program implements the guidance in GE-NE-523-A71-0594-A, Revision 1, “Alternate BWR Feedwater Nozzle Inspection Requirements,” dated May 2000. Cracking is detected through ultrasonic examinations of critical regions of the BWR feedwater nozzle, as depicted in Zones 1, 2, and 3 on [“Figure 4-1,” if the nozzle is clad, or “Figure 4-2,” if the nozzle is un-clad] of GE NE 523 A71-0594-A, Revision 1. The ultrasonic examination procedures, equipment, and personnel are qualified by performance demonstration in accordance with ASME Code, Section XI, Appendix VIII. The examination frequency for all three zones is once every 10-year ASME Code, Section XI, in-service inspection interval. Examination results are evaluated in accordance with ASME Code, Section XI, Subsection IWB-3130. *Description for plants that have single sleeve interference fit feedwater spargers:* This program is a condition monitoring program that manages the effects of cracking in the reactor vessel feedwater nozzles. This program implements the guidance in GE-NE-523-A71-0594-A, Revision 1, “Alternate BWR Feedwater Nozzle Inspection Requirements,” dated May 2000. Cracking is detected through ultrasonic examinations of critical regions of the BWR feedwater nozzle, as depicted in Zones 1, 2, and 3 on [“Figure 4-1,” if the nozzle is clad, or “Figure 4-2,” if the nozzle is un-clad] of GE NE 523 A71-0594-A, Revision 1. The ultrasonic examination procedures, equipment, and personnel are qualified by performance demonstration in accordance with ASME Code, Section XI, Appendix VIII. The examination frequency for Zones 1 and 2 is once every [X]		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		years, and the examination frequency for Zone 3 is once every [Y] years. Examination results are evaluated in accordance with ASME Code, Section XI, Subsection IWB-3130.		
~~XI.M6~~	~~BWR Control Rod Drive Return Line Nozzle~~	~~The program includes mandatory in-service inspection in accordance with ASME Code Section XI, Subsection IWB, Table IWB 2500-1 and augmented ISI examinations in accordance with the applicant's commitments to Generic Letter 80-095 to implement the recommendations in NUREG-0619.~~	~~Program should be implemented prior to period of extended operation~~	~~GALL IV / SRP 3.1~~
XI.M7	BWR Stress Corrosion Cracking	The program manages cracking due to ~~manage~~ intergranular stress corrosion cracking (IGSCC) ~~in~~for all BWR piping and piping welds made of austenitic stainless steel ~~or~~and nickel alloy ~~BWR~~ that are 4 inches or larger in nominal diameter containing reactor coolant ~~pressure boundary piping is delineated in NUREG-0313, Rev. 2, and~~ at a temperature above 93 °C (200 °F) during power operation, regardless of code classification. The program performs volumetric examinations to detect and manage IGSCC in accordance with NRC Generic Letter (GL) 88~~-~~-01. Modifications to the extent and schedule of inspection in GL 88-01 are allowed in accordance with the inspection guidance in staff-approved BWRVIP-75-A. This program relies on the staff-approved positions that are described in NUREG-0313, Revision 2, and GL 88-01 and its Supplement 1~~. The program includes (a) preventive measures to mitigate IGSCC and (b) inspection and flaw evaluation to monitor~~ regarding selection of IGSCC~~ and its effects.~~-resistant materials, solution heat treatment and stress improvement processes, water chemistry, weld overlay reinforcement, partial replacement, clamping devices, crack characterization and repair criteria, inspection methods and	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		personnel, inspection schedules, sample expansion, leakage detection, and reporting requirements.		
XI.M8	BWR Penetrations	The program includes BWR instrumentation penetrations, control rod drive (CRD) housing and incore-monitoring housing (ICMH) penetrations, and standby liquid control nozzles/Core ΔP nozzles. The program manages cracking due to cyclic loading or stress corrosion cracking by performing inspection and flaw evaluation in ~~conformance~~accordance with the guidelines of staff-approved ~~boiling water reactor vessel and internals project documents~~ BWRVIP-49-A, BWRVIP-47-A ~~, BWRVIP-49-A,~~ and BWRVIP-~~-~~27-A~~, to ensure~~ and the ~~long-term integrity and safe operation of BWR vessel internal components.~~ requirements in the ASME Code, Section XI. The examination categories include volumetric examination methods (ultrasonic testing or radiography testing), surface examination methods (liquid penetrant testing or magnetic particle testing), and visual examination methods.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1
XI.M9	BWR Vessel Internals	The program includes ~~inspection~~inspections and flaw ~~evaluation~~evaluations in conformance with the guidelines of applicable ~~and~~ staff-approved BWRVIP documents, and to ensure the long-term integrity and safe operation of BWR vessel internal components~~.~~ that are fabricated of nickel alloy and stainless steel (including martensitic stainless steel, cast stainless steel, and associated welds). ~~This program also consists of (1) determination of the susceptibility of cast austenitic stainless steel components, (2) accounting for the synergistic effect of thermal aging and neutron irradiation, and (3) implementing a supplemental examination program, as necessary.~~	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		~~This program also addresses aging degradation of X-750 alloy and precipitation-hardened (PH) martensitic stainless steel (e.g., 15-5 and 17-4 PH steel) materials and martensitic stainless steel (e.g., 403, 410, 431 steel) that are used in BWR vessel internal components.~~The program manages the effects of cracking due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), or irradiation-assisted stress corrosion cracking (IASCC), cracking due to cyclic loading (including flow-induced vibration), loss of material due to wear, loss of fracture toughness due to neutron or thermal embrittlement, and loss of preload due to thermal or irradiation-enhanced stress relaxation. The program performs inspections for cracking and loss of material in accordance with the guidelines of applicable staff-approved BWRVIP documents and the requirements of ASME Code, Section XI, Table IWB 2500-1. The impact of loss of fracture toughness on component integrity is indirectly managed by using visual or volumetric examination techniques to monitor for cracking in the components. This program also manages loss of preload for core plate rim holddown bolts and jet pump assembly holddown beam bolts by performing visual inspections or stress analyses to ensure adequate structural integrity. This program performs evaluations to determine whether supplemental inspections in addition to the existing BWRVIP examination guidelines are necessary to adequately manage loss of fracture toughness due to thermal or neutron embrittlement and cracking due to IASCC for the subsequent period of extended operation. If the evaluations determine that supplemental inspections are necessary for certain components based on neutron fluence, cracking susceptibility and fracture toughness, the program conducts the supplemental inspections for adequate aging management.		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
XI.M10	Boric Acid Corrosion	~~The program consists of (a) visual inspection of external surfaces that are potentially exposed to borated water leakage, (b) timely discovery of leak path and removal of the boric acid residues, (c) assessment of the damage, and (d) follow-up inspection for adequacy. This program is implemented in response to NRC GL 88-05 and recent operating experience.~~This program relies, in part, on the response to NRC Generic Letter 88-05, “Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants,” to identify, evaluate, and correct borated water leaks that could cause corrosion damage to reactor coolant pressure boundary components. The program also includes inspections, evaluations, and corrective actions for all components subject to aging management review that may be adversely affected by some form of borated water leakage. This program includes provisions to initiate evaluations and assessments when leakage is discovered by activities not associated with the program. This program follows the guidance described in Section 7 of WCAP-15988-NP, Revision 2, “Generic Guidance for an Effective Boric Inspection Program for Pressurized Water Reactors.”	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VI / SRP 3.6 GALL VII / SRP 3.3 GALL VIII / SRP 3.4 GALL III / SRP 3.5
XI.M11B	Cracking of Nickel-Alloy Components and Loss of Material due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary	~~This program addresses cracking of nickel-alloy components and loss of material due to boric acid-induced corrosion in susceptible, safety-related components in the vicinity of nickel-alloy reactor coolant pressure boundary components. It provides (a) inspection requirements for the PWR vessel, steam generator, pressurizer components, and piping if they contain the primary water stress corrosion cracking (PWSCC) susceptible materials designated alloys 600/82/182 and (b) inspection requirements for reactor pressure vessel upper heads.~~This program addresses operating experience of degradation due to primary water stress corrosion cracking	~~Program should be~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
	Components (PWRS only)	(PWSCC) of components or welds constructed from certain nickel alloys (e.g., Alloy 600/82/182) and exposed to pressurized water reactor primary coolant at elevated temperature. The scope of this program includes the following groups of components and materials: (a) all nickel alloy components and welds which are identified in EPRI MRP-126; (b) nickel alloy components and welds identified in ASME Code Cases N-770, N-729 and N-722, as incorporated by reference in 10 CFR 50.55a; and (c) components that are susceptible to corrosion by boric acid and may be impacted by leakage of boric acid from nearby or adjacent nickel alloy components previously described. This program is used in conjunction with GALL-SLR Report AMP XI.M2, “Water Chemistry” because water chemistry can affect the cracking of nickel alloys. The completeness of the plant’s EPRI MRP-126 program is also verified prior to entering the subsequent period of extended operation. For nickel alloy components and welds addressed by the regulatory requirements of 10 CFR 50.55a, inspections are conducted in accordance with 10 CFR 50.55a. Unless required at a greater frequency by 10 CFR 50.55a, all susceptible nickel alloy components and welds (e.g., Alloy 600/82/182 branch connection nozzles and welds) are volumetrically inspected at an interval not to exceed 10 years if such components or welds are: (a) in contact with reactor coolant; and (b) relied upon for substantial strength of the components or welds, and are of sufficient size to create a loss of coolant accident (LOCA) through a completed failure (guillotine break) or ejection of the component. Other nickel alloy components and welds within the scope of this program are inspected in accordance with EPRI MRP-126.		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		This program also performs an inspection of bottom-mounted instrumentation (BMI) nozzles of reactor pressure vessels using a qualified volumetric examination method. The inspection is conducted on all BMI nozzles prior to the subsequent period of extended operation to ensure adequate management of cracking due to PWSCC. If this inspection indicates the occurrence of PWSCC, periodic volumetric inspections are performed on these nozzles and adequate inspection periodicity is established. Alternatively, plant-proposed and staff-approved mitigation methods may be used to manage the aging effect for these components.		
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	The program consists of the determination of the susceptibility potential significance of loss of fracture toughness due to thermal aging embrittlement of CASS piping~~, piping components,~~ and piping ~~elements~~components in both the BWR and PWR reactor coolant pressure boundaries emergency core cooling system (ECCS) systems, including interfacing pipe lines to the chemical and volume control system and to the spent fuel pool; and in BWR ECCS systems, including interfacing pipe lines to the suppression chamber and to the drywell and suppression chamber spray system in regard to thermal aging embrittlement based on the casting method, molybdenum content, and ferrite percentage. For potentially susceptible piping~~,~~ and piping components aging management is accomplished either through enhanced volumetric examination ~~or~~, enhanced visual examination, or a component-specific flaw tolerance evaluation.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2
~~XI.M16A~~	~~PWR Vessel Internals~~	~~The program relies on implementation of the EPRI Report No. 1016596 (MRP-227) and EPRI Report No. 1016609 (MRP-228) to manage the aging effects on the reactor vessel internal components.~~ ~~This program is used to manage (a) various forms of cracking, including SCC, PWSCC, irradiation-assisted~~	~~Program should be implemented prior to period of extended operation~~	~~GALL IV / SRP 3.1~~

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		~~stress corrosion cracking (IASCC), or cracking due to fatigue/cyclical loading; (b) loss of material induced by wear; (c) loss of fracture toughness due to either thermal aging or neutron irradiation embrittlement; (d) dimensional changes and potential loss of fracture toughness due to void swelling and irradiation growth; and (e) loss of preload due to thermal and irradiation-enhanced stress relaxation or creep.~~		
XI.M17	Flow-Accelerated Corrosion (FAC)	The program ~~consists of (a) conducting appropriate analysis and baseline inspections, (b) determining~~ is based on the ~~extent of thinning and replacement/repair of components, and (c) performing follow-up inspections~~response to ~~confirm or quantify and take long-term corrective actions. The program~~ NRC Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning," and relies on implementation of ~~EPRI~~the Electric Power Research Institute guidelines ~~of NSAC-~~in the Nuclear Safety Analysis Center 202L-~~R2~~ [(as applicable) Revision 2, 3, or 4], "Recommendations for an Effective Flow Accelerated Corrosion Program." The program includes the use of predictive analytical software [(as applicable) CHECWORKS™, BRT CICERO™, COMSY]. This program also manages wall thinning caused by mechanisms other than FAC, in situations where periodic monitoring is used in lieu of eliminating the cause of various erosion mechanisms.] This program includes (a) identifying all susceptible piping systems and components; (b) developing FAC predictive models to reflect component geometries, materials, and operating parameters; (c) performing analyses of FAC models and, with consideration of operating experience, selecting a sample of components for inspections; (d) inspecting components; (e) evaluating inspection data to determine the need for	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		inspection sample expansion, repairs, or ~~R3~~replacements, and to schedule future inspections; and (f) incorporating inspection data to refine FAC models.		
XI.M18	Bolting Integrity	This program focuses on closure bolting for pressure-retaining components and relies on recommendations for a comprehensive bolting integrity program, as delineated in NUREG-1339, and industry recommendations, as delineated in EPRI NP-5769, with the exceptions noted in NUREG-1339 for safety-related bolting. The program also relies on industry recommendations for comprehensive bolting maintenance, as delineated in the EPRI TR-104213, 1015336 and 1015337. The program generally includes periodic inspection of closure bolting for indications of loss of preload, cracking, and loss of material due to corrosion, rust, etc. The program also includes preventive measures to preclude or minimize loss of preload and cracking. A related aging management program (AMP) XI.M1, “ASME Section XI Inservice Inspection (ISI) Subsections IWB, IWC, and IWD,” includes inspections of safety-related and non-safety-related closure bolting and supplements this bolting integrity program. Other related programs, AMPs XI.S1, “ASME Section XI, Subsection IWE”; XI.S3, “ASME Section XI Subsection IWF”; XI.S6, “Structures Monitoring”; XI.S7, “~~RG 1.127, “~~Inspection of Water-Control Structures Associated with Nuclear Power Plant”; and XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems,” manage the inspection of safety-related and non-safety related structural bolting.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4
XI.M19	Steam Generators	This program consists of aging management activities for the steam generator tubes, plugs, sleeves, and secondary side components~~ that are contained within the steam generator in accordance with the ~~. This program	~~Existing program~~SLR program is implemented prior to	GALL IV / SRP 3.1

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		is governed by plant technical specifications~~ and includes~~, commitments to NEI 97-06~~.~~, Revision 3, and the associated EPRI guidelines. The program also includes foreign material exclusion as a means to inhibit wear degradation, and secondary side maintenance activities, such as sludge lancing, for removing deposits that may contribute to component degradation. The program performs volumetric examination on steam generator tubes in accordance with the requirements in the technical specifications to detect aging effects, if they should occur. The technical specifications require condition monitoring and operational assessments to be performed to ensure that the tube integrity will be maintained until the next inspection. Condition monitoring and operational assessments are done in accordance with the technical specification requirements and guidance in NEI 97-06, Revision 3. The program also includes inspections of steam generator components in accordance with the guidance in NEI 97-06, Revision 3.	the subsequent period of extended operation	
XI.M20	Open-Cycle Cooling Water System	~~This~~The program relies, in part, on implementing the response to NRC ~~GL~~Generic Letter 89-13, ~~which~~"Service Water System Problems Affecting Safety-Related Equipment," [(if applicable) and includes nonsafety-related portions of the open-cycle cooling water system]. The program includes (a) surveillance and control of biofouling, (b) tests to verify heat transfer of heat exchangers, (c) routine inspection and maintenance ~~program, (d) system walkdown inspection, and (e) review of maintenance,~~to ensure that corrosion, erosion, protective coating failure, fouling, and biofouling cannot degrade the performance of systems serviced by the open-cycle cooling water system. This program includes enhancements to the guidance in NRC GL 89-13 that address operating~~, and training practices and procedures. The Open-Cycle Cooling Water System program applies to components constructed of various materials,~~	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		~~including steel, stainless steel, aluminum copper alloys, polymeric materials, and concrete~~ experience to ensure aging effects are adequately managed.		
XI.M21A	Closed Treated Water Systems	~~The program includes~~This is a mitigation program that also includes condition monitoring to verify the effectiveness of the mitigation activities. The program consists of (a) water treatment, including the use of corrosion inhibitors, to modify the chemical composition of the water such that the ~~function of the equipment is maintained and such that the~~ effects of corrosion are minimized; (b) chemical testing of the water to ensure that the water treatment program maintains the water chemistry within acceptable guidelines; and (c) inspections to determine the presence or extent of ~~corrosion and/or cracking.~~degradation. The program uses ((as applicable) e.g., EPRI 1007820, Closed Cooling Water Chemistry Guideline, and corrosion coupon testing and microbiological testing).	Program should be implemented prior to subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4
XI.M22	Boraflex Monitoring	The program consists of (a) neutron attenuation testing (“blackness testing”) to determine gap formation, (b) sampling for the presence of silica in the spent fuel pool along with boron loss, and (c) monitoring and analysis of criticality to assure that the required 5% sub-criticality margin is maintained. This program is implemented in response to NRC GL 96-04.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation m	GALL VII / SRP 3.3
XI.M23	Inspection of Overhead Heavy Load and Light Load Handling Related to Refueling) Handling Systems	The program evaluates the effectiveness of ~~the~~ maintenance monitoring ~~program and the effects of past and future usage on the structural reliability of~~ activities for cranes and hoists. The ~~number and magnitude of lifts made by the hoist or crane are also reviewed. Rails and girders are visually inspected on a routine basis for~~ program includes periodic visual inspections to detect degradation~~; functional tests are performed to assure their integrity.~~ of bridge, rail, and trolley structural components and loss of preload on bolted connections. Volumetric or surface examinations confirm the	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL VII / SRP 3.3

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		absence of cracking in high strength bolts. This program relies on the guidance in NUREG-0612, ASME B30.2, and other appropriate standards in the ASME B30 series. These cranes must also comply with the maintenance rule requirements provided in 10 CFR 50.65.		
XI.M24	Compressed Air Monitoring	The program consists of monitoring moisture content and corrosion, and performance of the ~~entire~~compressed air system, including (a) preventive monitoring of water (moisture), and other contaminants to keep within the specified limits and (b) inspection of components for indications of loss of material due to corrosion. This program is in response to NRC GL 88-14 and INPO's Significant Operating Experience Report (SOER) 88-01. It also relies on the guidance from the American Society of Mechanical Engineers (ASME) operations and maintenance standards and guides (ASME OM ~~Guide~~-S/G-2012, Division 2, Part ~~17 and~~ 28) and American National Standards Institute (ANSI)/ISA-~~S~~7.0.1-1996 ~~as guidance~~ , and EPRI TR-10847 for testing and monitoring air quality and moisture. Additionally, periodic visual inspections of component internal surfaces are performed for signs of loss of material due to corrosion.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL VII / SRP 3.3
XI.M25	BWR Reactor Water Cleanup System	This program includes ISI and monitoring and control of reactor coolant water chemistry. Related to the inspection guidelines for the reactor water cleanup system (RWCU) inspections of RWCU piping welds that are located outboard of the second containment isolation valve, the program includes measures delineated in per the guidelines of NUREG-0313, Revision 2, and NRC GL 88-01, GL 88-01 Supplement 1, and any applicable NRC-approved alternatives to these guidelines and ISI in conformance with the ASME Section XI.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL VII, SRP 3.3
XI.M26	Fire Protection	~~The~~This program includes fire barrier inspections. The fire barrier inspection program requires periodic visual inspection	~~Existing program~~SLR program is	GALL VII / SRP 3.3

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		of fire barrier penetration seals, fire barrier walls, ceilings, and floors, fire damper housings, and periodic visual inspection and functional tests of fire-rated doors to ensure that their operability is maintained. The program also includes periodic inspection and testing of halon/carbon dioxide fire suppression systems.	implemented prior to the subsequent period of extended operation	
XI.M27	Fire Water System	~~This program consists of periodic full-flow flush tests, system performance tests to prevent corrosion from biofouling components in the fire protection system, and testing or replacement of sprinklers that have been in place for 50 years. The~~This program is a condition monitoring program that manages aging effects associated with water-based fire protection system components. This program manages loss of material, fouling, and flow blockage because of fouling by conducting periodic visual inspections, tests, and flushes performed in accordance with the 2011 Edition of NFPA 25. Testing or replacement of sprinklers that have been in place for 50 years is performed in accordance with NFPA 25. In addition to NFPA codes and standards, portions of the water-based fire protection system that are: (a) normally dry but periodically subjected to flow and (b) cannot be drained or allow water to collect are subjected to augmented testing beyond that specified in NFPA 25, including: (a) periodic system full flow tests at the design pressure and flow rate or internal visual inspections and (b) piping volumetric wall-thickness examinations. The water-based fire protection system is normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated. ~~The program relies on the testing of piping and components in the water-based fire protection system in accordance with applicable National Fire Protection Association (NFPA) commitments. In addition, this~~	~~Program should be implemented prior to period of extended operation~~Program is implemented 5 years before the subsequent period of extended operation. Inspections of wetted normally dry piping segments that cannot be drained or that allow water to collect begin 5 years before the subsequent period of extended operation. The program's remaining inspections begin during the subsequent period of extended operation	GALL VII / SRP 3.3

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		~~program can be modified to include (a) portions of the fire protection sprinkler system that are subjected to full flow tests prior to the period of extended operation, and (b) portions of the fire protection system exposed to water are internally visually inspected.~~ Piping wall thickness measurements are conducted when visual inspections detect surface irregularities indicative of unexpected levels of degradation. When the presence of sufficient organic or inorganic material sufficient to obstruct piping or sprinklers is detected, the material is removed and the source is detected and corrected. Non-code inspections and tests follow site procedures that include inspection parameters for items such as lighting, distance offset, presence of protective coatings, and cleaning processes that ensure an adequate examination.		
XI.M29	Aboveground Metallic Tanks	~~This~~This program is a condition monitoring program that manages aging effects associated with outdoor tanks sited on soil or concrete and indoor large-volume tanks containing water designed with internal pressures approximating atmospheric pressure that are sited on concrete or soil, including the [applicant to list the specific tanks that are in the program scope]. The program includes preventive measures to mitigate corrosion by protecting the external surfaces of steel components~~,~~ per standard industry practice~~, with~~. Sealant or caulking is used for outdoor tanks at the concrete-component interface. ~~Visual inspection during~~ This program manages loss of material and cracking by conducting periodic ~~system walkdowns should be sufficient to monitor degradation of the protective paint, coating, calking,~~internal and external visual and surface examinations. Inspections of caulking or sealant~~. Program effectiveness is determined by measuring the thickness of the~~ are supplemented with physical manipulation. Surface exams	~~Existing program~~Program is implemented and inspections begin 10 years before the subsequent period of extended operation.	GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		are conducted to detect cracking when susceptible materials are used. Thickness measurements of tank bottoms are conducted to ensure that significant degradation is not occurring ~~and that the component's intended function is maintained during the period of extended operation~~. The external surfaces of insulated tanks are periodically sampling-based inspected. Inspections not conducted in accordance with ASME Code Section XI requirements are conducted in accordance with plant-specific procedures including inspection parameters such as lighting, distance, offset, and surface conditions.		
XI.M30	Fuel Oil Chemistry	~~The~~This program relies on a combination of surveillance and maintenance procedures. Monitoring and controlling fuel oil contamination in accordance with the guidelines of American Society for Testing and Materials (ASTM) Standards D1796, D2276, D2709, and D4057 maintains the fuel oil quality. Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by periodic cleaning/draining of tanks and by verifying the quality of new oil before its introduction into the storage tanks.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL VII / SRP 3.3
XI.M31	Reactor Vessel Material Surveillance	This program~~, extending the scope~~ requires implementation of a reactor vessel material surveillance program to monitor the changes in fracture toughness to the ferritic reactor vessel beltline materials which are projected to receive a peak neutron fluence at the end of the design life of the vessel exceeding 10^{17} n/cm^{2} (E >1MeV). The surveillance capsules must be located near the inside vessel wall in the beltline region so that the material specimens duplicate, to the greatest degree possible, the neutron spectrum, temperature history, and maximum neutron fluence experienced at the reactor vessel's inner surface. Because of the resulting lead	The surveillance capsule withdrawal schedule revised before the subsequent period of extended operation	~~GALL IV / SRP 3.1~~ Reactor Vessel Surveillance

Table 3.0-1.	FSAR Supplement for Aging Management of Applicable Systems for SLR			
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		factors, surveillance capsules receive equivalent neutron fluence exposures earlier than the inner surface of the reactor vessel. This allows surveillance capsules to be withdrawn prior to the inner surface receiving an equivalent neutron fluence and therefore test results may bound the corresponding operating period in the capsule withdrawal schedule. This surveillance program must comply with ASTM International (formerly American Society for Testing and Materials) Standard Practice E 185-82, as incorporated by reference in 10 CFR Part 50, Appendix H~~, “~~. Because the withdrawal schedule in Table 1 of ASTM E 185-82 is based on plant operation during the original 40-year license term, standby capsules may need to be incorporated into the Appendix H program to ensure appropriate monitoring during the subsequent period of extended operation. Surveillance capsules are designed and located to permit insertion of replacement capsules. If standby capsules will be incorporated into the Appendix H program for the subsequent period of extended operation and have been removed from the reactor vessel, these should be reinserted so that appropriate lead factors are maintained and test results will bound the corresponding operating period. This program includes removal and testing of at least one capsule during the subsequent period of extended operation, with a neutron fluence of the capsule between one and one and one quarter (1.25) the projected peak vessel neutron fluence at the end of the subsequent period of extended operation.		

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		As an alternative to a plant-specific surveillance program complying with ASTM E 185-82, an integrated surveillance program (ISP) may be considered for a set of reactors that have similar design and operating features, in accordance with 10 CFR Part 50, Appendix H, and Paragraph III.C. The plant-specific implementation of the ISP is consistent with the latest version of the ISP plan that has received approval by the NRC for the subsequent period of extended operation. The objective of this Reactor Vessel Material Surveillance program ~~Requirements," provides~~is to provide sufficient material data and dosimetry to (a) monitor irradiation embrittlement to neutron fluences greater than the projected neutron fluence at the end of the subsequent period of extended operation, and ~~to determine the need for operating restrictions on~~(b) provide adequate dosimetry monitoring during the ~~inlet temperature, neutron spectrum, and neutron flux.~~operational period. If surveillance capsules are not withdrawn during the subsequent period of extended operation, ~~operating restrictions~~provisions are made to ~~be established to ensure~~perform dosimetry monitoring. This program is a condition monitoring program that measures the ~~plant is operated under~~ increase in Charpy V-notch 30 foot-pound (ft-lb) transition temperature and the ~~conditions~~drop in the upper-shelf energy as a function of neutron fluence and irradiation temperature. The data from this surveillance program are used to monitor neutron irradiation embrittlement of the reactor vessel, and		

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		are inputs to the neutron embrittlement time-limited aging analyses (TLAAs) described in Section 4.2 of the Standard Review Plan for Subsequent License Renewal (SRP-SLR). The Reactor Vessel Material Surveillance program is also used in conjunction with GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring,” which ~~the~~ monitors neutron fluence for reactor vessel components and reactor vessel internal components. In accordance with 10 CFR Part 50, Appendix H, all surveillance capsules ~~were exposed. All capsules in the reactor vessel that are~~, including those previously removed ~~and tested~~from the reactor vessel, must meet the test procedures and reporting requirements of ASTM E 185-82, to the extent practicable, for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including ~~spare capsules~~the conversion of standby capsules into the Appendix H program and extension of the surveillance program for the subsequent period of extended operation, must be approved by the Nuclear Regulatory Commission (NRC) prior to implementation~~. Untested~~, in accordance with 10 CFR Part 50, Appendix H, Paragraph III.B.3. Standby capsules placed in storage ~~must be~~(e.g., removed from the reactor vessel) are maintained for possible future insertion.		
XI.M32	One-Time Inspection	The program ~~consists~~is a condition monitoring program consisting of a one-time inspection of selected components to verify: (a) the system-wide effectiveness of an AMP that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the subsequent period of extended operation~~.~~; (b) the insignificance of an aging effect; and (c) that long-term loss of materials will not cause a loss of intended function for steel components	~~Program~~Inspections should be ~~implemented~~conducted prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		exposed to environments that do not include corrosion inhibitors as a preventive action, and where periodic wall thickness measurements on a representative sample of each environment are not conducted every 5 years up to at least 10 years prior to the subsequent period of extended operation. This program provides inspections that verify that unacceptable degradation is not occurring. It also may trigger additional actions that ensure the intended functions of affected components are maintained during the subsequent period of extended operation. The elements of the program include (a) determination of the sample size of components to be inspected based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience~~,~~~~(~~, (b) identification of the inspection locations in the system or component based on the potential for the aging effect to occur, (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined, and (d) an evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the subsequent period of extended operation. This program ~~cannot be~~is not used for structures or components with known age-related degradation mechanisms or when the environment in the subsequent period of extended operation is not expected to be equivalent to that in the prior ~~40 years.~~operating periods. Periodic inspections ~~should be proposed~~are conducted in these cases. Inspections not conducted in accordance with ASME Code Section XI requirements are conducted in accordance		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		with plant-specific procedures including inspection parameters such as lighting, distance, offset, and surface conditions.		
XI.M33	Selective Leaching	~~The~~This program is a condition monitoring program that includes a one-time ~~visual~~ inspection for components exposed to a closed-cycle cooling water or treated water environment when plant-specific operating experience has not revealed selective leaching in these environments. Opportunistic and periodic inspections are conducted for raw water, waste water, soil, and groundwater environments, and for closed-cycle cooling water and treated water environments when plant-specific operating experience has revealed selective leaching in these environments. Visual inspections coupled with ~~either hardness measurement or other~~ mechanical examination techniques such as chipping or scraping are conducted. Periodic destructive ~~testing, scraping, or chipping~~ examinations of ~~selected components that may be susceptible to selective leaching. This is~~ components for physical properties (i.e., degree of dealloying, depth of dealloying, through wall thickness, and chemical composition) are conducted for components exposed to raw water, waste water, soil, and groundwater environments, or for closed-cycle cooling water and treated water environments when plant-specific operating experience has revealed selective leaching in these environments. Inspections and tests are conducted to determine whether loss of ~~materials is occurring and whether the process~~material will affect the ability of the components to perform their intended function for the subsequent period of extended operation. Inspections are conducted in accordance with plant-specific procedures including inspection parameters such as lighting, distance, offset and surface conditions. When the acceptance criteria are not met such that it is determined that the affected component should	SLR program should be implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		be replaced prior to the end of the subsequent period of extended operation, additional inspections are performed.		
XI.M35	~~One-Time Inspection of~~ ASME Code Class 1 Small Bore-Piping	This program augments the existing ASME Code, Section XI requirements and is applicable to small-bore ASME Code Class 1 piping and systems with a nominal pipe size diameter less than 4 inches (NPS<4) and greater than or equal to NPS 1. This program provides a one-time volumetric inspection of a sample of this Class 1 piping. ~~The~~ This program includes pipes, fittings, branch connections, and all full and partial penetration (socket) welds. The program includes measures to verify that degradation is not occurring, thereby either confirming that there is no need to manage aging-related degradation or validating the effectiveness of any existing program for the subsequent period of extended operation. The one-time inspection program for ASME Code Class 1 small-bore piping includes locations that are susceptible to cracking. This program is applicable to systems that have not experienced cracking of ASME Code Class 1 small-bore piping. This program can also be used for systems that experienced cracking but have implemented design changes to effectively mitigate cracking. (Measure of effectiveness includes (1) the one-time inspection sampling is statistically significant; (2) samples will be selected as described in Element 5; and (3) no repeated failures over an extended period of time.) For systems that have experienced cracking and operating experience indicates design changes have not been implemented to effectively mitigate cracking, periodic inspection is proposed, as managed by a plant-specific AMP. Should evidence of cracking be revealed by a one-time inspection, a periodic inspection is also proposed, as managed by a plant-specific AMP.	SLR program should be implemented prior to subsequent period of extended operation	GALL IV / SRP 3.1
XI.M36	External Surfaces Monitoring of	This program is ~~based on system inspections and walkdowns. This~~a condition monitoring program ~~consists of~~that manages loss of material, cracking, changes in	~~Existing program~~Program is implemented 6 months	GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
	Mechanical Components	material properties (of cementitious components), hardening and loss of strength (of elastomeric components), and reduced thermal insulation resistance. Periodic visual inspections, not to exceed a refueling outage interval, of metallic ~~and~~, polymeric ~~components, such as piping, piping components, ducting, polymeric~~, insulation jacketing (insulation when not jacketed), and cementitious components~~, and other~~ are conducted. For certain materials, such as flexible polymers, physical manipulation or pressurization to detect hardening or loss of strength is used to augment the visual examinations conducted under this program. A sample of outdoor component surfaces that are insulated and a sample of indoor insulated components~~. The program manages aging effects through visual~~ exposed to condensation (due to the in-scope component being operated below the dew point), are periodically inspected every 10 years during the subsequent period of extended operation. Inspections not conducted in accordance with ASME Code Section XI requirements are conducted in accordance with plant-specific procedures including inspection ~~of external surfaces for evidence of loss of material, cracking, and change in material properties. When appropriate for the component~~ parameters such as lighting, distance, offset, and ~~material, manipulation may be used to augment visual~~surface conditions. Acceptance criteria are such that the component will meet its intended function until the next inspection ~~to confirm the absence of elastomer hardening and loss of strength~~or the end of the subsequent period of extended operation. Qualitative acceptance criteria are clear enough to reasonably ensure a singular decision is derived based on observed conditions.	before the subsequent period of extended operation and inspections begin during the subsequent period of extended operation.	

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
XI.M37	Flux Thimble Tube Inspection	The program inspects for the thinning of flux thimble tube walls, which provides a path for the in-core neutron flux monitoring system detectors and forms part of the reactor coolant system pressure boundary. Flux thimble tubes are subject to loss of material at certain locations in the reactor vessel where flow-induced fretting causes wear at discontinuities in the path from the reactor vessel instrument nozzle to the fuel assembly instrument guide tube. A periodic nondestructive examination methodology, such as eddy current testing~~,~~ or other applicant-justified and US NRC-accepted inspection methods ~~are~~is used to monitor flux thimble tube wear. This program implements the recommendations of NRC Bulletin 88~~-~~-09, “Thimble Tube Thinning in Westinghouse Reactors.”	~~Existing Program~~SLR program is implemented prior to the subsequent period of extended operation	GALL IV / SRP 3.1
XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	~~The~~This program is a condition monitoring program that manages loss of material, cracking, and hardening and loss of strength of polymeric materials. This program consists of visual inspections of ~~the~~all accessible internal surfaces of metallic piping, piping components, ducting, heat exchanger components, polymeric and elastomeric components, and other components that are exposed to environments of uncontrolled indoor air, outdoor air, air with borated water leakage, condensation, moist air, diesel exhaust, and any water ~~systems~~environment other than open-cycle cooling water, ~~treated~~closed-cycle cooling water, and fire water~~ that are exposed to environments of air – indoor, uncontrolled; air – outdoor; condensation. ~~. Elastomers exposed to open-cycle, closed-cycle cooling water, and fire water are managed by this program. These internal inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. ~~The program includes~~	~~Existing program~~Program is implemented 6 months before the subsequent period of extended operation and inspections begin during the subsequent period of extended operation.	GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4 GALL VI / SRP 3.6

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~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		~~visual~~ At a minimum, in each 10-year period during the period of extended operation a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population is inspected. Where practical, the inspections focus on the bounding or lead components most susceptible to ~~ensure that existing environmental~~aging because of time in service, and severity of operating conditions ~~are not causing material degradation that could result in a loss of the component's intended function.~~. Opportunistic inspections continue in each period despite meeting the sampling limit. For certain materials, such as flexible polymers, physical manipulation or pressurization ~~(e.g., hydrotesting)~~ to detect hardening or loss of strength is used to augment the visual examinations conducted under this program. If visual inspection of internal surfaces is not possible, ~~then the applicant needs to provide~~ a plant-specific program is used. Inspections not conducted in accordance with ASME Code Section XI requirements are conducted in accordance with plant-specific procedures including inspection parameters such as lighting, distance, offset, and surface conditions. Acceptance criteria are such that the component will meet its intended function until the next inspection or the end of the subsequent period of extended operation. Qualitative acceptance criteria are clear enough to reasonably ensure a singular decision is derived based on observed conditions.		
XI.M39	Lubricating Oil Analysis	This program ensures that the oil environment in the mechanical systems is maintained to the required quality. ~~The~~ This program ensures that oil systems are maintained free of contaminants (primarily water and particulates), thereby preserving an environment that is not conducive to loss of material or reduction of heat transfer. Testing	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
		activities include sampling and analysis of lubricating oil for detrimental contaminants. The presence of water or particulates may also indicate in-leakage and corrosion product buildup.		
XI.M40	Monitoring of Neutron-Absorbing Materials other than Boraflex	This program relies on periodic inspection, testing, monitoring, and analysis of the criticality design to assure that the required 5 percent sub-criticality margin is maintained. This program consists of inspecting the physical condition of the neutron-absorbing material, such as visual appearance, dimensional measurements, weight, geometric changes (e.g., formation of blisters, pits, and bulges), and boron areal density as observed from coupons or in situ.	SLR program should be implemented prior to the subsequent period of extended operation	GALL VII / SRP 3.3
XI.M41	Buried and Underground Piping and Tanks	This ~~comprehensive~~ program is ~~designed to manage~~ a condition monitoring program that manages the aging ~~of~~effects associated with the external surfaces of buried and underground piping and tanks~~.~~ such as loss of material, cracking and changes in material properties (for cementitious piping). It addresses piping and tanks composed of any material, including metallic, polymeric, ~~concrete,~~ and cementitious materials. The program also manages aging through preventive~~,~~ and mitigative~~, and~~ actions, (i.e., coatings, backfill quality, and cathodic protection) The number of inspections is based on the effectiveness of the preventive and mitigative actions. Annual cathodic protection surveys are conducted. Where the acceptance criteria for the effectiveness of the cathodic protection is other than -850 mV instant off, actual loss of material rates are measured from in-situ coupons. Inspections are conducted by qualified individuals. Adverse inspection ~~activities. It manages all applicable aging effects, such as loss of material, cracking, and changes in material properties~~results result in additional inspections. If a	~~Inspections to~~SLR program should be ~~completed~~implemented before the subsequent period of extended operation	GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		reduction in the number of inspections recommended in GALL-SLR Report AMP XI.M41, Table XI.M41-1, is claimed based on a lack of soil corrosivity as determined by soil testing, soil testing is conducted once in each 10-year period starting 10 years prior to the subsequent period of extended operation.		
XI.M42	Internal Coatings/Linings for In Scope Piping, Piping Components, Heat Exchangers, and Tanks	This program is a condition monitoring program that manages degradation of coatings/linings that can lead to loss of material of base materials and downstream effects such as reduction in flow, reduction in pressure or reduction in heat transfer when coatings/linings become debris. This program manages these aging effects by conducting periodic visual inspections of all coatings/linings applied to the internal surfaces of in-scope components exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil or fuel oil where loss of coating or lining integrity could impact the component's or downstream component's current licensing basis intended function(s). For tanks and heat exchangers, all accessible surfaces are inspected. Piping inspections are sampling-based. The training and qualification of individuals involved in coating/lining inspections of noncementitious coatings/linings are conducted in accordance with ASTM International Standards endorsed in RG 1.54 including guidance from the staff associated with a particular standard. For cementitious coatings, training and qualifications are based on an appropriate combination of education and experience related to inspecting concrete surfaces. Peeling and delamination is not acceptable. Blisters are evaluated by a coatings specialist with the blisters being surrounded by sound material and with the size and frequency not increasing. Minor cracks in cementitious coatings are acceptable provided there is no evidence of debonding. All	Program is implemented no later than six months before the subsequent period of extended operation and inspections begin no later than the last refueling outage before the subsequent period of extended operation.	GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		other degraded conditions are evaluated by a coatings specialist. For coated/lined surfaces determined to not meet the acceptance criteria, physical testing is performed where physically possible (i.e., sufficient room to conduct testing) in conjunction with repair or replacement of the coating/lining.		
XI.S1	ASME Section XI, Subsection IWE Inservice Inspection (IWE)	~~The~~ This program is in accordance with ASME Section XI, Subsection IWE ~~program consists of~~ , consistent with 10 CFR 50.55a “Codes and standards,” with supplemental recommendations. The AMP includes periodic visual, surface, ~~and~~ volumetric ~~inspection of~~examinations, and leak rate testing, where applicable, of metallic pressure-retaining components of steel containments and concrete containments for signs of degradation, ~~assessment of~~ damage, irregularities including liner plate bulges, and for coated areas distress of the underlying metal shell or liner, and corrective actions. ~~The~~ Acceptability of inaccessible areas of steel containment shell or concrete containment steel liner is evaluated when conditions found in accessible areas, indicate the presence of, or could result in, flaws or degradation in inaccessible areas. This program also includes aging management for the potential loss of material due to corrosion in the inaccessible areas of the BWR Mark I steel containment, and surface examination for the detection of cracking of structural bolting. ~~This program is in accordance with ASME Section XI, Subsection IWE, 2004 edition.~~ In addition, the program includes supplemental surface or enhanced examinations to detect cracking for specific components [identify components], and supplemental volumetric examinations by sampling locations susceptible to loss of thickness due to corrosion of containment shell or liner that is inaccessible from one side. Inspection results are compared with prior recorded results in acceptance of components for continued service.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL II / SRP 3.5

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
XI.S2	ASME Section XI, Subsection IWL Inservice Inspection (IWL)	~~The ASME Section XI, Subsection IWL~~This program consists of (a) periodic visual inspection of concrete surfaces for reinforced and ~~prestressed~~pre-stressed concrete containments, (b) periodic visual inspection and sample tendon testing of ~~unbonded~~un-bonded post-tensioning systems for ~~prestressed~~pre-stressed concrete containments for signs of degradation, assessment of damage, and corrective actions, and testing of the tendon corrosion protection medium and free water. Measured tendon lift-off forces are compared to predicted tendon forces calculated in accordance with RG 1.35.~~1. This program is in accordance with ASME Section XI, Subsection IWL, 2004 edition.~~ The Subsection IWL requirements are supplemented to include quantitative acceptance criteria for concrete surfaces based on the "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL II / SRP 3.5
XI.S3	ASME Section XI, Subsection IWF Inservice inspection (IWF)	This program consists of periodic visual examination of piping and component supports ~~and high-strength structural bolting~~ for signs of degradation, evaluation, and corrective actions. This program ~~is in accordance with~~recommends additional inspections beyond the inspections required by the 10 CFR Part 50.55a ASME Section XI, Subsection IWF~~, 2004 edition.~~ program. This includes inspections of an additional 5 percent of supports outside of the existing IWF sample population. For high-strength bolting in sizes greater than 1 inch nominal diameter, volumetric examination comparable to that of ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1 should be performed to detect cracking in addition to the VT-3 examination. If a component support does not exceed the acceptance standards of IWF-3400 but is electively repaired to as-new condition, the sample is increased or modified to include	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL II / SRP 3.5 GALL III / SRP 3.5

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		another support that is representative of the remaining population of supports that were not repaired.		
XI.S4	10 CFR Part 50, Appendix J	This program consists of monitoring leakage rates through the containment system, its shell or liner~~/~~, associated welds, penetrations, isolation valves, fittings, and other access openings to detect degradation of the containment pressure boundary. Corrective actions are taken if leakage rates exceed acceptance criteria. This program is implemented in accordance with 10 CFR Part 50 Appendix J, RG 1.163 and/or NEI 94-01~~, Rev. 0~~.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL II / SRP 3.5
XI.S5	Masonry Walls	~~The~~This program consists of inspections, based on IE Bulletin 80-11 and plant-specific monitoring proposed by IN 87-67, for managing shrinkage, separation, gaps, loss of material and cracking of masonry walls such that the evaluation basis is not invalidated and intended functions are maintained.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL III / SRP 3.5
XI.S6	Structures Monitoring	~~The~~This program consists of periodic visual inspection and monitoring the condition of concrete and steel structures~~ and structure~~, structural components, component supports, and structural commodities to ensure that aging degradation ~~leading to loss of intended functions~~(such as those described in ACI 349.3R, ACI 201.1R, SEI/ASCE 11, and other documents) will be detected~~ and that~~, the extent of degradation ~~can be~~ determined~~. This program is implemented in accordance~~, evaluated, and corrective actions taken prior to loss of intended functions. Inspections also include seismic joint fillers, elastomeric materials; and steel edge supports and steel bracings associated with ~~NUMARC 93-01, Rev. 2 and RG 1.160, Rev. 2.~~masonry walls, and periodic evaluation of groundwater chemistry and opportunistic inspections for the condition of below grade concrete, and of protective coatings for substrate materials. Quantitative results (measurements) and qualitative data from periodic	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL VII / SRP 3.3 GALL II / SRP 3.5 GALL III / SRP 3.5 GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		inspections are trended with photographs and surveys for the type, severity, extent, and progression of degradation. The acceptance criteria are derived from applicable consensus codes and standards. For concrete structures, the program includes personnel qualifications and quantitative acceptance criteria of ACI 349.3R.		
XI.S7	~~R.G. 1.127,~~ Inspection of Water-Control Structures Associated with Nuclear Power Plants	~~The~~This program consists of inspection and surveillance ~~programs for dams, slopes, canals, intake structure, and other~~ of raw-water -control structures associated with emergency cooling ~~water~~ systems or flood protection ~~based on RG 1.127, Rev. 1.~~. The program also includes structural steel and structural bolting associated with water-control structures~~, steel or wood piles and sheeting required for the stability of embankments and channel slopes, and miscellaneous steel, such as sluice gates and trash racks.~~. In general, parameters monitored should be in accordance with Section C.2 of R.G. 1.127 and quantitative measurements should be recorded for all applicable parameters monitored or inspected. Inspections should occur at least once every 5 years. Structures exposed to aggressive water require additional plant-specific investigation.	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL III / SRP 3.5
XI.S8	Protective Coating Monitoring and Maintenance	~~This~~This program ensures that a monitoring and maintenance program implemented in accordance with RG 1.54 is adequate for the subsequent period of extended operation. The program consists of guidance for selection, application, inspection, and maintenance of protective coatings. ~~This program is implemented in accordance with RG 1.54, Rev. 1 or latest revision.~~ Maintenance of Service Level I coatings applied to carbon steel and concrete surfaces inside containment (e.g., steel liner, steel containment shell, structural steel, supports, penetrations, and concrete walls and floors) serve to prevent or minimize loss of material due to corrosion of carbon steel components and aids in	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL III / SRP 3.5

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		decontamination. Degraded coatings in the containment are assessed periodically to ensure post-accident operability of the ECCS.		
X.M1	Cyclic Load Monitoring	The aging management program monitors and tracks the number of occurrences and severity of each of the thermal and pressure transients and requires corrective actions to ensure that applicable fatigue analyses remain within their allowable limits, including those in applicable CUF analyses, CUFen analyses, maximum allowable stress range reduction analyses for ANSI B31.1 and ASME Code Class 2 and 3 components, ASME III fatigue waiver analyses, and cycle-based flaw growth, flaw tolerance, or fracture mechanics analyses. The program manages cracking induced by fatigue or cyclic loading occurrences in plant structures and components by monitoring one or more relevant fatigue parameters, which include the CUF, the CUFen, transient cycle limits, and the predicted flaw size. The program has two aspects, one to verify the continued acceptability of existing analyses through cycle counting and the other to provide periodically updated evaluations of the fatigue analyses to demonstrate that they continue to meet the appropriate limits. Plant technical specification requirements may apply to these activities.		
X.M2	Neutron Fluence Monitoring	This program monitors and tracks increasing neutron fluence exposures (integrated, time-dependent neutron flux exposures) to reactor pressure vessel and reactor internal components to ensure that applicable reactor pressure vessel neutron irradiation embrittlement analyses (i.e., TLAAs) and radiation-induced aging effect assessment for reactor internal components will remain within their applicable limits. This program has two aspects, one to verify the continued acceptability of existing analyses through neutron fluence monitoring and the other to provide periodically updated		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		evaluations of the analyses involving neutron fluence inputs to demonstrate that they continue to meet the appropriate limits defined in the current licensing basis (CLB). Monitoring is performed in accordance with neutron flux determination methods and neutron fluence projection methods that are defined for the CLB in NRC-approved reports. For fluence monitoring activities that apply to components located in the beltline region of the reactor pressure vessel(s), the monitoring methods are performed in a manner that is consistent with the monitoring methodology guidelines in Regulatory Guide (RG) 1.190, “Calculational .and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence,” March 2001. Additional justifications may be necessary for neutron fluence monitoring methods that are applied to reactor pressure vessel component locations outside of the beltline region of the vessels or to reactor internal components. This program’s results are compared to the neutron fluence parameter inputs used in the neutron embrittlement analyses for reactor pressure vessel components. This includes but is not limited to the neutron fluence inputs for the reactor pressure vessel upper shelf energy analyses (or equivalent margin analyses, as applicable to the CLB), pressure-temperature analyses, and low temperature overpressure protection (LTOP, PWRs only) that are required to be performed in accordance in 10 CFR Part 50, Appendix G requirements, and for PWRs, those safety analyses that are performed to demonstrate adequate protection of the reactor pressure vessels against the consequences of pressurized thermal shock (PTS) events, as required by 10 CFR 50.61 or 10 CFR 50.61a and applicable to the CLB. Comparisons to the neutron fluence inputs for other analyses (as applicable to the CLB) may include those for mean RT_{NDT} and probability		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		of failure analyses for BWR reactor pressure vessel circumferential and axial shell welds, BWR core reflood design analyses, and aging effect assessments for PWR and BWR reactor internals that are induced by neutron irradiation exposure mechanisms. Reactor vessel surveillance capsule dosimetry data obtained in accordance with 10 CFR Part 50, Appendix H requirements and through implementation of the applicant's Reactor Vessel Surveillance Program (Refer to GALL-SLR Report AMP XI.M31) may provide inputs to and have impacts on the neutron fluence monitoring results that are tracked by this program. In addition, regulatory requirements in the plant technical specifications or in specific regulations of 10 CFR Part 50 may apply, including those in 10 CFR Part 50, Appendix G; 10 CFR 50.55a; and for PWRs, the PTS requirements in 10 CFR 50.61 or 10 CFR 50.61a, as applicable for the CLB.		
X.S1	Concrete Containment Tendon Prestress	The prestressing unbonded 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 unbonded tendons diminish over time due to losses in prestressing forces in the tendons and in the surrounding concrete. The prestressing force analysis and evaluation has been completed and determined to remain within allowable limits to the end of the subsequent period of extended operation, and the trend lines of the measured prestressing forces will stay above the minimum required prestressing forces for each group of tendons to the end of this period.		
X.E1	Environmental Qualification	This program implements the environmental qualification (EQ) requirements in 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. 10 CFR 50.49 specifically requires that		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR

~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
	(EQ) of Electric Components	an EQ program be established to demonstrate that certain electrical equipment located in harsh plant environments will perform their safety function in those harsh environments after the effects of in-service aging. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification. As required by 10 CFR 50.49, EQ equipment not qualified for the current license term is refurbished, replaced, or have their qualification extended prior to reaching the designated life aging limits established in the evaluation. Aging evaluations for EQ equipment that specify a qualification of at least 60 years are time-limited aging analyses (TLAAs) for subsequent license renewal. Reanalysis of an aging evaluation to extend the qualification of equipment qualified under the program requirements of 10 CFR 50.49(e) is performed as part of an EQ program. Important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied during the prior evaluation. The identification of excess conservatism in electrical equipment service conditions (for example, temperature, radiation, and cycles) used in the prior aging evaluation is the chief method used for a reanalysis. A reanalysis demonstrates that adequate margin is maintained consistent with the original analysis in accordance with 10 CFR 50.59 requiring certain margins and accounting for the unquantified uncertainties established in the EQ aging evaluation of the equipment. Reanalysis of an aging evaluation is used to extend the environmental qualification of		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		the component. If the qualification cannot be extended by reanalysis, the equipment is refurbished, replaced, or requalified prior to exceeding the current qualified life. When the reanalysis assessed margins, conservatisms, or assumptions do not support reanalysis (e.g., extending qualified life) of an EQ component, the use of on-going qualification techniques including condition monitoring or condition based methodologies may be implemented. Ongoing qualification is an alternative means to provide reasonable assurance that an equipment environmental qualification is maintained for the subsequent period of extended operation. On-going qualification of electric equipment important to safety subject to the requirements of 10 CFR 50.49 involves the inspection, observation, measurement, or trending of one or more indicators, which can be correlated to the condition or functional performance of the EQ equipment. This program is implemented in accordance 10 CFR 50.49 and 10 CFR 54.21(c)(1)(iii). Along with GALL-SLR Report AMP X.E1 the environmental qualification program demonstrates the acceptability of the TLAA analysis under 10 CFR 54.21(c)(1) and is considered an aging management programs (AMP) for the subsequent period of extended operation. This program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience including research and development (e.g., test methods, aging models, acceptance criterion) such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.		

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		[The FSAR Summary description also includes a plant specific discussion of applicable commitments, license conditions, enhancements, or exceptions applied to the applicants aging management program]		
SRP-SLR Appendix A	Plant-Specific AMP	The [fill in name of program] Program is a [prevention, mitigation, condition monitoring, performance monitoring] program that manages aging effects associated with [list component type or system as applicable that are in the scope of the program]. Preventive or mitigative actions include [fill in key actions when applicable]. The program manages [list the AERM] by conducting [periodic, one-time] [describe inspection methods and tests] of [all components or a representative sample of components] within the scope of the program. [When applicable, Periodic inspections are conducted every XX years commencing prior to or during the subsequent period of extended operation] [Describe how inspection and test implementing procedures are controlled (e.g., non-code inspections and tests follow site procedures that include inspection parameters for items such as lighting, distance offset, presence of protective coatings, and cleaning processes that ensure an adequate examination)]. Qualitative acceptance criteria are clear enough to reasonably ensure a singular decision is derived based on observed conditions. When the acceptance criteria are not met such that it is determined that the affected component should be replaced prior to the end of the subsequent period of extended operation, additional inspections are performed.	Program should be implemented prior to subsequent period of extended operation	GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VII / SRP 3.3 GALL VIII / SRP 3.4 GALL II-III / SRP 3.5 GALL VI / SRP 3.6
GALL-SLR Appendix A	Quality Assurance	The 10 CFR Part 50, Appendix B quality assurance program provides the basis for corrective actions, the confirmation process, and administrative controls for AMPs for license renewal. The scope of this existing program is expanded to include ~~nonsafety~~non-safety-related structures and	~~Existing program~~SLR program is implemented prior to the subsequent period of extended operation	GALL VII / SRP 3.3 GALL VIII / SRP 3.4 GALL III / SRP 3.5 GALL VI / SRP 3.6

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
		components that are subject to ~~an AMR for license renewal~~aging management programs.		
~~SRP~~GALL-SLR Appendix ~~A~~B	~~Plant-Specific AMP~~Operating Experience	~~The program should contain information associated with the bases for determining that aging effects will be managed during the period of extended operation.~~This program captures the operating experience from plant-specific and industry sources and is systematically reviewed on an ongoing basis in accordance with the quality assurance program, which meets the requirements of 10 CFR Part 50, Appendix B, and the operating experience program, which meets the requirements of NUREG-0737, “Clarification of TMI Action Plan Requirements,” Item I.C.5, “Procedures for Feedback of Operating Experience to Plant Staff.” This program interfaces with and relies on active participation in the Institute of Nuclear Power Operations’ (INPO) operating experience program, as endorsed by the NRC. In accordance with these programs, all incoming operating experience items are screened to determine whether they may involve age-related degradation or aging management impacts. Items so identified are further evaluated and the AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed. Training on age-related degradation and aging management is provided to those personnel responsible for implementing the AMPs and who may submit, screen, assign, evaluate, or otherwise process plant-specific and industry operating experience. Plant-specific operating experience associated with aging management and age-related degradation is reported to the industry in accordance with guidelines established in the operating experience program.	~~Program should be~~SLR program is implemented prior to the subsequent period of extended operation	GALL II-III / SRP 3.5 GALL IV / SRP 3.1 GALL V / SRP 3.2 GALL VI / SRP 3.6 GALL VII / SRP 3.3 GALL VIII / SRP 3.4 ~~GALL II-III / SRP 3.5~~ ~~GALL VI / SRP 3.6~~

*An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the subsequent period of extended operation.

Table 3.0-1. FSAR Supplement for Aging Management of Applicable Systems for SLR				
~~GALL Chapter~~ AMP	GALL-SLR Program	Description of Program	Implementation Schedule*	Applicable GALL-SLR Report and SRP-~~LR~~SLR Chapter References
The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.				

3.1 Aging Management Of Reactor Vessel, Internals, And Reactor Coolant System

Review Responsibilities

Primary~~ - Branch~~—The Branch's assigned responsibility by Project Manager (PM) as described in this Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-~~LR~~SLR) Section 3.0~~ of this SRP-LR~~.

3.1.1 Areas of Review

This section addresses the aging management review (AMR) and the associated aging management program (AMP) of the reactor vessel, internals, and reactor coolant system. For a recent vintage plant, the information related to the reactor vessel, internals, and 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 (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants" (NUREG~~-~~–0800). For older plants, the location of applicable information is plant-specific because an older plant's FSAR may have predated NUREG~~-~~–0800.

The reactor vessel, internals, and reactor coolant system includes the reactor vessel and internals. For boiling water reactors (BWRs), this system also includes 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 pressurized water reactors (PWRs), the reactor coolant system includes the primary coolant loop, the pressurizer, and the steam generators~~.~~ (SGs). For PWRs the reactor coolant system also includes the pressurizer relief tank, which is not an American Society of Mechanical Engineers (ASME) Code Class 1 component. 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 responsible review organization is to review the following subsequent license renewal application (~~LRA~~SLRA) AMR and AMP items assigned to it, per SRP-~~LR~~SLR Section 3.0:

AMRs

- AMR results consistent with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
- AMR results for which further evaluation is recommended ~~by the GALL Report~~
- AMR results not consistent with or not addressed in the GALL-SLR Report

AMPs

Consistent with GALL-SLR Report AMPs (including those with enhancements and/or exceptions)

- Plant-specific AMPs

FSAR Supplement

- The responsible review organization is to review the FSAR Supplement associated with each assigned AMP.

3.1.2 Acceptance Criteria

The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the ~~NRC's~~U.S. Nuclear Regulatory Commission (NRC) regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21.

3.1.2.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The AMR and the AMPs applicable to the reactor vessel, internals, and reactor coolant system are described and evaluated in Chapter IV of ~~NUREG-1801 (~~the GALL-SLR Report~~)~~..

The applicant's ~~LRA~~SLRA should provide sufficient information so that the reviewer is able to confirm that the specific ~~LRA~~SLRA AMR item and the associated ~~LRA~~SLRA AMP are consistent with the cited GALL-SLR Report AMR item. The reviewer should then confirm that the ~~LRA~~SLRA AMR item is consistent with the GALL-SLR Report AMR item to which it is compared. When the applicant is crediting a different ~~aging management program~~AMP than recommended in the GALL-SLR Report, the reviewer should confirm that the alternate ~~aging management program~~AMP is valid to use for aging management and will be capable of managing the effects of aging as adequately as the ~~aging management program~~AMP recommended by the GALL-SLR Report.

3.1.2.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic acceptance criteria defined in Subsection 3.1.2.1 need to be applied first for all of the AMRs and AMPs reviewed as part of this section. In addition, if ~~the GALL Report AMR item to which the LRA AMR item is compared identifies that~~ further evaluation is recommended, then additional criteria apply ~~as identified by the GALL Report~~ for each of the following aging effect/aging mechanism combinations. Refer to Table 3.1-1, comparing the "Further Evaluation Recommended" and the "~~Rev2 Item" columns~~GALL-SLR" column, for the AMR items that reference the following subsections. ~~The 2005 AMR item counterpart is provided in the "Rev1 Item" column.~~

3.1.2.2.1 Cumulative Fatigue Damage

~~Fatigue is a~~ The evaluations of fatigue or cyclical loading stresses may be time-limited aging ~~analysis (TLAA)~~analyses (TLAAs), as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). ~~This TLAA is~~ These types of TLAAs are addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-~~LR~~SLR.

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

1. Loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR ~~steam generator~~SG upper and lower shell and transition cone exposed to secondary feedwater and steam. The existing program relies on control of water chemistry to mitigate corrosion and inservice inspection (ISI) to detect loss of material. The extent and schedule of the existing ~~steam generator~~SG inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC Information Notice (IN) 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," the program may not be sufficient to detect pitting and crevice corrosion~~,~~ if general and pitting corrosion of the shell is known to exist. ~~The GALL Report recommends~~ Augmented inspection is recommended to manage this aging effect. Furthermore,~~ the GALL Report clarifies that~~ this issue is limited to Westinghouse Model 44 and 51 Steam Generators, where a high-stress region exists at the shell to transition cone weld. Acceptance criteria are described in Branch Technical Position (BTP) RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

2. Loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. The existing program relies on control of secondary water chemistry to mitigate corrosion. However, some applicants have replaced only the bottom part of their recirculating ~~steam generators~~SGs, generating a cut in the middle of the transition cone, and, consequently, a new transition cone closure weld. ~~The GALL Report recommends~~ It is recommended that volumetric examinations be performed in accordance with the requirements of ASME Code Section XI for upper shell~~-to~~ and lower shell-to-transition cones with gross structural discontinuities for managing loss of material due to general, pitting, and crevice corrosion in the welds for Westinghouse Model 44 and 51 Steam Generators, where a high-stress region exists at the shell-to-transition cone weld.

The new continuous circumferential weld, resulting from cutting the transition cone as discussed above, is a different situation from the SG transition cone welds containing geometric discontinuities. Control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. The new transition area weld is a field -weld as opposed to having been made in a controlled manufacturing facility, and the surface conditions of the transition weld may result in flow conditions more conducive to initiation of general, pitting, and crevice corrosion than those of the upper and lower transition cone welds. Crediting of the ISI program for the new SG transition cone weld may not be an effective basis for managing loss of material in this weld, as the ISI criteria would only perform a VT-2 visual leakage examination of the weld as part of the system leakage test performed pursuant to ASME Section XI requirements. In addition, ASME Section XI does not require licensees to remove insulation when performing visual examination on ~~non-borated~~nonborated treated water systems. Therefore, the effectiveness of the chemistry control program should be verified to ensure that loss of material due to general, pitting and crevice corrosion is not occurring.

For the new continuous circumferential weld, ~~the GALL Report recommends~~ further evaluation is recommended to verify the effectiveness of the chemistry control program. A one-time inspection at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly, such that the component's intended function will be maintained during the subsequent period of extended operation. Furthermore, ~~the GALL Report clarifies that~~ this issue is limited to replacement of recirculating ~~steam generators~~SGs with a new transition cone closure weld.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

1. Neutron irradiation embrittlement is a TLAA to be evaluated for the subsequent period of extended operation for all ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 ~~(~~[E >1 MeV~~)~~] at the end of the ~~license renewal term.~~subsequent period of extended operation. Certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). This TLAA is addressed separately in Section 4.2, "Reactor Vessel Neutron Embrittlement Analysis," of this SRP-~~LR~~SLR Report.

2. Loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A reactor vessel ~~materials~~material surveillance program monitors neutron irradiation embrittlement of the reactor vessel. The reactor vessel material surveillance program is plant-specific, depending on matters such as the composition of limiting materials~~,~~ and the availability of surveillance capsules~~, and projected fluence levels.~~ .

   In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further NRC staff evaluation is required for ~~license renewal.~~SLR. Specific recommendations for an acceptable AMP are provided in ~~Chapter XI,~~GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance."

   A neutron fluence monitoring program is used to monitor the neutron fluence levels that are used as the time-dependent inputs for the plant's reactor vessel neutron irradiation embrittlement TLAAs. These TLAAs are the subjects of the topics discussed in SRP-SLR Section ~~M31 of the GALL Report.~~ 3.1.2.2.3.1 and "acceptance criteria" and "review procedure" guidance in SRP-SLR Section 4.2. Specific recommendations for an acceptable neutron fluence monitoring AMP are provided in GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring."

3. ~~Ductility –~~ Reduction in Fracture Toughness is a plant-specific TLAA for Babcock ~~and~~& Wilcox (B&W) reactor internals to be evaluated for the subsequent period of extended operation in accordance with the NRC staff's safety evaluation concerning "Demonstration of the Management of Aging Effects for the Reactor Vessel Internals," ~~Babcock and Wilcox~~B&W Owners Group report number BAW-2248, which is included in BAW-2248A, March 2000. Plant-specific TLAAs are addressed in Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," of this SRP-~~LR~~SLR.

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

1. Cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC) could occur in the stainless steel (SS) and nickel alloy BWR top head enclosure vessel flange leak detection lines. ~~The~~ The Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or

detecting cracking due to SCC and IGSCC. Acceptance criteria are described in Branch Technical Position (BTP) RLSB-1 (Appendix A.1 of this SRP~~-LR).~~ -SLR Report).

2. Cracking due to SCC and IGSCC could occur in ~~stainless steel~~SS BWR isolation condenser components exposed to reactor coolant. The existing program relies on control of reactor water chemistry to mitigate SCC and on ASME Section XI ISI to detect cracking. However, the existing program should be augmented to detect cracking due to SCC and IGSCC. ~~The GALL Report recommends~~ An augmented program is recommended to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes to ensure that the component's intended function will be maintained during the subsequent period of extended operation. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR).~~ SLR Report).

3.1.2.2.5 Crack Growth Due to Cyclic Loading

Crack growth due to cyclic loading could occur in reactor vessel shell forgings clad with ~~stainless steel~~SS using a high-heat-input welding process. Growth of intergranular separations (underclad cracks) in the heat-affected zone under austenitic ~~stainless steel~~SS cladding is a TLAA to be evaluated for the subsequent period of extended operation for all the SA-508-Cl-2 forgings where the cladding was deposited with a high-heat-input welding process. The methodology for evaluating the underclad flaw should be consistent with the flaw evaluation procedure and criterion in the ASME Section XI Code~~, 2004 edition~~[2]~~. See the SRP-LR, Section 4.7, "Other Plant-Specific Time-Limited Aging Analysis," for generic guidance for meeting the requirements of 10 CFR 54.21(c).~~[3].

See SRP-SLR, Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21(c).

3.1.2.2.6 Cracking Due to Stress Corrosion Cracking

1. Cracking due to SCC could occur in the PWR ~~stainless steel~~SS reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. ~~The GALL Report recommends~~ Further evaluation is recommended to ensure that these aging effects are adequately managed. ~~The GALL Report recommends that~~ A plant-specific AMP should be evaluated to ensure that this aging effect is adequately managed. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR).~~ SLR Report).

2. Cracking due to SCC could occur in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping~~, piping components,~~ and piping ~~elements~~components exposed to reactor coolant. The existing program relies on control of water chemistry to mitigate SCC; however, SCC could occur for CASS components that do not meet the NUREG-–0313, "Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary Piping" guidelines with regard to ferrite and carbon content. ~~The GALL Report recommends~~ Further evaluation is recommended of a plant-

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~~[2] Refer to the GALL Report, Chapter I, for applicability of other editions of the ASME Code, Section XI.~~

[3] Refer to the GALL-SLR Report, Chapter I, for applicability of other editions of the ASME Code, Section XI.

specific program for these components to ensure that this aging effect is adequately managed. Acceptance criteria are described in ~~Branch Technical Position~~ BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.1.2.2.7 Cracking Due to Cyclic Loading

Cracking due to cyclic loading could occur in steel and ~~stainless steel~~SS BWR isolation condenser components exposed to reactor coolant. The existing program relies on ASME Section XI ISI. However, the existing program should be augmented to detect cracking due to cyclic loading. ~~The GALL Report recommends~~ An augmented program is recommended to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes to ensure that the component's intended function will be maintained during the subsequent period of extended operation. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB~~-~~-1 (Appendix A.1 of this SRP-~~LR).~~SLR Report).

3.1.2.2.8 Loss of Material Due to Erosion

Loss of material due to erosion could occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. ~~The GALL Report recommends~~ Further evaluation is recommended of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.1.2.2.9 ~~Cracking due~~Aging Management of Pressurized Water Reactor Vessel Internals (Applicable to ~~Stress Corrosion Cracking~~Subsequent License Renewal Periods Only)

Electric Power Research Institute (EPRI) Topical Report (TR) No. 1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and ~~Irradiation-Assisted Stress Corrosion Cracking~~ Evaluation Guidelines (MRP-227-A)" [henceforth TR Materials Reliability Program (MRP)-227-A, which may be accessed at ADAMS Accession Nos. ML12017A191 through ML12017A197 and ML12017A199], provides the industry's current aging management recommendations for the reactor vessel internal (RVI) components that are included in the design of a PWR facility. In this report, the EPRI MRP identified that the following aging mechanisms may be applicable to the design of the RVI components in these types of facilities: (a) SCC, (b) irradiation-assisted stress corrosion cracking (IASCC), (c) fatigue, (d) wear, (e) neutron irradiation embrittlement, (f) thermal aging embrittlement, (g) void swelling and irradiation growth, or (h) thermal or irradiation-enhanced stress relaxation or irradiation enhanced creep. The methodology in TR MRP-227-A was approved by the NRC in a safety evaluation dated December 16, 2011 (ML11308A770), which includes those plant-specific applicant/licensee action items that a licensee or applicant applying the MRP-227-A report would need to address and resolve and apply to its licensing basis.

~~Cracking due to SCC and irradiation-assisted stress corrosion cracking (IASCC) could occur in inaccessible locations for stainless steel and nickel-alloy Primary and Expansion PWR reactor vessel internal components. If aging effects are identified in accessible locations, the GALL Report recommends further evaluation of the aging effects in inaccessible locations on a plant-specific basis to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).~~

~~*1.1.1.1.1 3.1.2.2.10 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement, Change in Dimension due to Void Swelling, Loss of Preload due to Stress Relaxation, or Loss of Material due to Wear*~~

~~Loss of fracture toughness due to neutron irradiation embrittlement, change in dimension due to void swelling, loss of preload due to stress relaxation, or loss of material due to wear could occur in inaccessible locations for stainless steel and nickel-alloy Primary and Expansion PWR reactor vessel internal components. If aging effects are identified in accessible locations, the GALL Report recommends further evaluation of the aging effects in inaccessible locations on a plant-specific basis to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).~~

The EPRI MRP's functionality analysis and failure modes, effects, and criticality analysis (FMECA) bases for grouping Westinghouse-designed, B&W-designed and Combustion Engineering (CE)-designed RVI components into these inspection categories was based on an assessment of aging effects and relevant time-dependent aging parameters through a cumulative 60-year licensing period (i.e., 40 years for the initial operating license period plus an additional 20 years during the initial period of extended operation). The EPRI MRP has yet to assess whether potential operations of Westinghouse-designed, B&W-designed and CE-designed reactors during a SLR period would have any impact on the existing susceptibility rankings and inspection categorizations for the RVI components in these designs, as defined in TR MRP-227-A or its applicable MRP background documents (e.g., TR MRP-191 for Westinghouse-designed or CE-designed RVI components or MRP-189 for B&W-designed components).

Therefore, for PWR facilities' SLRAs, a plant-specific AMP for the RVI components will be needed to demonstrate that the RVI components will be managed in accordance with the requirements of 10 CFR 54.21(a)(3) during the proposed SLR period. Components for inspection, parameters monitored, monitoring methods, inspection sample size, frequencies, expansion criteria, and acceptance criteria are to be justified in the SLRA. The NRC staff will assess the adequacy of the plant-specific AMP against the criteria for the 10 AMP program elements that are defined in Sections A.1.2.3.1 through A.1.2.3.10 of SRP-SLR Appendix A.1.

3.1.2.2.10 Loss of Material Due to Wear

1. Industry operating experience indicates that loss of material due to wear can occur in PWR control rod drive (CRD) head penetration nozzles made of nickel alloy due to the interactions between the nozzle and the thermal sleeve centering pads of the nozzle (see Ref. 31). The CRD head penetration nozzles are also called control rod drive mechanism (CRDM) nozzles or CRDM head adapter tubes. The applicant should perform a further evaluation to confirm the adequacy of a plant-specific AMP or analysis (with any necessary inspections) for management of the aging effect. The applicant may use the acceptance criteria, which are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report), to demonstrate the adequacy of a plant-specific AMP. Alternatively, the applicant may perform an analysis with any necessary inspections to confirm that loss of material due to wear does not affect the intended function(s) of these CRD head penetration nozzles, consistent with the current licensing basis (CLB).

2. Industry operating experience indicates that loss of material due to wear can occur in the SS thermal sleeves of PWR CRD head penetration nozzles due to the interactions

between the nozzle and the thermal sleeve (e.g., where the thermal sleeve exits from the head penetration nozzle inside the reactor vessel as described in Ref. 32). Therefore, the applicant should perform a further evaluation to confirm the adequacy of a plant-specific AMP for management of the aging effect. The applicant may use the acceptance criteria, which are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report), to demonstrate the adequacy of a plant-specific AMP.

3.1.2.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

1. Foreign operating experience in steam generators with a similar design to that of Westinghouse Model 51 has identified ~~extensive~~ cracking due to primary water stress corrosion cracking (PWSCC) in ~~steam generator (~~SG~~)~~ divider plate assemblies fabricated of Alloy 600 and/or the associated Alloy 600 weld materials, even with proper primary water chemistry (EPRI TR-1014982). Cracks have been detected in the stub runner, adjacent to the tubesheet/stub runner weld~~ and with depths of almost a third of the divider plate thickness.~~. Therefore, the water chemistry program may not be effective in managing the aging effect of cracking due to PWSCC in SG divider plate assemblies. This is of particular concern for ~~steam generators~~SGs where the tube-to-tubesheet welds are considered structural welds and/or where the divider plate assembly contributes to the mechanical integrity of the ~~tubesheet~~tube-to-tube sheet welds.

   Although these SG divider plate cracks may not have a significant safety impact in and of themselves, these cracks could impact adjacent items, such as the tube-to-tubesheet welds and the channel head, if they propagate to the boundary with these items. For the tube-to-tubesheet welds, PWSCC cracks in the divider plate could propagate to the tubesheet cladding with possible consequences to the integrity of the tube~~/~~-to-tubesheet welds. For the channel head, the PWSCC cracks in the divider plate could propagate to the SG triple point and potentially affect the pressure boundary of the SG channel head.

   The existing program may rely on control of reactor water chemistry to mitigate cracking due to PWSCC. A plant-specific AMP should be evaluated, along with the primary water chemistry program, because the existing primary water chemistry program may not be capable of mitigating cracking due to PWSCC. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

2. Cracking due to PWSCC could occur in SG nickel alloy tube-to-tubesheet welds exposed to reactor coolant. Unless the NRC has approved a redefinition of the pressure boundary in which the tube-to-tubesheet weld is no longer included, the effectiveness of the primary water chemistry program should be verified to ensure cracking is not occurring:

   - For plants with Alloy 600 SG tubes that have not been thermally treated and for which an alternate repair criteria such as C*, F*, or W* has been permanently approved, the weld is no longer part of the pressure boundary and no plant specific AMP is required;

   - For plants with Alloy 600 steam generator tubes that have not been thermally treated and for which there is no permanently approved alternate repair criteria such as C*, F*, or W*, a plant-specific AMP is required;

- For plants with Alloy 600TT SG tubes and for which an alternate repair criteria such as H* has been permanently approved, the weld is no longer part of the pressure boundary and no plant specific AMP is required;

- For plants with Alloy 600TT SG tubes and for which no alternate repair criteria such as H* permanently approved, a plant-specific AMP is required;

- For plants with Alloy 690TT SG tubes with Alloy 690 tubesheet cladding, the water chemistry is sufficient, and no further action or plant-specific AMP is required;

- For plants with Alloy 690TT SG tubes and with Alloy 600 tubesheet cladding, either a plant-specific program or a rationale for why such a program is not needed is required.

The existing program relies on control of reactor water chemistry to mitigate cracking due to PWSCC. ~~The GALL Report recommends that~~ A plant-specific AMP should be evaluated, along with the primary water chemistry program, because the existing primary water chemistry program may not be capable of mitigating cracking due to PWSCC. Acceptance criteria are described in ~~Branch Technical Position~~ BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.1.2.2.12 Cracking Due to ~~PWSCC~~Irradiation-Assisted Stress Corrosion Cracking

1. GALL-SLR Report AMP XI.M9, “BWR Vessel Internals,” manages aging degradation of nickel alloy and SS, including associated welds, which are used in BWR vessel internal components. When exposed to the BWR vessel environment, these materials can experience cracking due to IASCC. The existing Boiling Water Reactor Vessel and Internals Project (BWRVIP) examination guidelines are mainly based on aging evaluation of BWR vessel internals for operation up to 60 years. However, increases in neutron fluence during the SLR term may need to be assessed for supplemental inspections of BWR vessel internals to adequately manage cracking due to IASCC. Therefore, the applicant should perform an evaluation to determine whether supplemental inspections are necessary in addition to those recommended in the existing BWRVIP examination guidelines. If the applicant determines that supplemental inspections are not necessary, the applicant should provide adequate technical justification for the determination. If supplemental inspections are determined necessary for BWR vessel internals, the applicant identifies the components to be inspected and performs supplemental inspections to adequately manage IASCC. In addition, the applicant should confirm the adequacy of any necessary supplemental inspections and enhancements to the BWRVIP.

2. The GALL-SLR Report recommends AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for managing IASCC for the core shroud support plate access hole cover (welded or mechanical). GALL-SLR Report AMP XI.M1 manages the aging effect by performing visual examinations. The GALL-SLR AMP also performs augmented inspections using ultrasonic testing (UT) or other demonstrated acceptable techniques if the welded access hole cover has a crevice which is not amenable to visual examinations. Cracking due to IASCC in this component can be facilitated by the increases in

neutron fluence during the subsequent period of extended operation. Therefore, an evaluation should be performed to determine whether supplemental inspections are necessary for adequate aging management in addition to the existing ASME Code examination as augmented for crevices. The applicant should also confirm the adequacy of any necessary supplemental inspections and enhancements to the ASME Section XI ISI, Subsections IWB, IWC, and IWD program.

3.1.2.2.13 Loss of Fracture Toughness Due to Neutron Irradiation or Thermal Aging Embrittlement

GALL-SLR Report AMP XI.M9 manages aging degradation of nickel alloy and SS, including associated welds, which are used in BWR vessel internal components. When exposed to the BWR vessel environment, these materials can experience loss of fracture toughness due to neutron irradiation embrittlement. In addition, CASS, precipitation-hardened (PH) martensitic SS (e.g., 15-5 and 17-4 PH steel) and martensitic SS (e.g., 403, 410, 431 steel) can experience loss of fracture toughness due to neutron irradiation and thermal aging embrittlement.

The existing BWRVIP examination guidelines are mainly based on aging evaluation of BWR vessel internals for operation up to 60 years. Increases in neutron fluence and thermal embrittlement during the SLR term may need to be assessed for supplemental inspections of BWR vessel internals to adequately manage loss of fracture toughness due to neutron irradiation or thermal aging embrittlement. Therefore, the applicant should perform an evaluation to determine whether supplemental inspections are necessary in addition to those recommended in the existing BWRVIP examination guidelines. If the applicant determines that supplemental inspections are not necessary, the applicant should provide adequate technical justification for the determination. If supplemental inspections are determined necessary for BWR vessel internals, the applicant should identify the components to be inspected and perform supplemental inspections to adequately manage loss of fracture toughness. In addition, the applicant should confirm the adequacy of any necessary supplemental inspections and enhancements to the BWRVIP.

3.1.2.2.14 Loss of Preload Due to Thermal or Irradiation-Enhanced Stress Relaxation

GALL-SLR Report AMP XI.M9 manages loss of preload due to thermal or irradiation-enhanced stress relaxation in BWR core plate rim holddown bolts. The issue is applicable to BWR-designed light water reactors that employ rim holddown bolts as the means for protecting the reactor’s core plate from the consequences of lateral movement. The potential for such movement, if left unmanaged, could impact the ability of the reactor to be brought to a safe shutdown condition during an anticipated transient occurrence or during a postulated design-basis accident or seismic event. This issue is not applicable to BWR reactor designs that use wedges as the means of precluding lateral movement of the core plate because the wedges are fixed in place and are not subject to this type of aging effect and mechanism combination.

GALL-SLR Report AMP XI.M9 states that the inspections in BWRVIP TR No. BWRVIP-25, “BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25),” are used to manage loss of preload due to thermal or irradiation-enhanced stress relaxation in BWR designs with core plate rim holddown bolts. However, in previous LRAs, some applicants have identified that the inspection bases for managing loss of preload in

TR No. BWRVIP-25 may not be capable of gaining access to the rim holddown bolts or are not sufficient to detect loss of preload on the components. For applicants that have identified this issue in their past LRAs, the applicants either committed to modifying the plant design to install wedges in the core plate designs or to submit an inspection plan, with a supporting core plate rim holddown bolt preload analysis for NRC approval at least 2 years prior to entering into the initial period of extended operation for the facility.

For SLRAs that apply to BWRs with core plate rim holddown bolts, the NRC staff recommends that an enhanced augmented inspection basis for the bolts be proposed and justified, with a supporting loss of preload analysis. If an existing NRC-approved analysis for the bolts exists in the CLB and conforms to the definition of a TLAA, the applicant should identify the analysis as a TLAA for the LRA and demonstrate how the analysis is acceptable in accordance with either 10 CFR 54.21(c)(1)(i), (ii), or (iii). Otherwise, if a new analysis will be performed to support an updated augmented inspection basis for the bolts for the subsequent period of extended operation, the NRC staff recommends that a license renewal commitment be placed in the FSAR supplement for the applicant to submit both the inspection plan and the supporting loss of preload analysis to the NRC staff for approval at least 2 years prior to entering into the subsequent period of extended operation for the facility.

3.1.2.2.15 Loss of Material Due to Boric Acid Corrosion

Foreign operating experience identified loss of material due to boric acid corrosion in the steel base material of a recirculating SG channel head. This corrosion primarily occurs when the plant is shutdown and the steam generators are exposed to oxygen. The observed loss of material was volumetric in the form of one large cavity. The loss of material was associated with an area where the channel head cladding did not fully cover the steel base material. The cause of the missing cladding is not currently known. This operating experience indicates that if SG head cladding is compromised (e.g., due to cracking, manufacturing defects or foreign material impingement damage), loss of material due to boric acid corrosion could occur in the steel base material of the SG head (i.e., recirculating steam generator ~~nickel alloy tube-to-tubesheet welds~~channel head and once-through SG upper and lower heads).

The existing program may rely on control of reactor water chemistry to mitigate loss of material due to boric acid corrosion for SG head base material when the cladding of this component was compromised and the steel base material was exposed to reactor coolant. ~~Unless the NRC has approved a redefinition of the pressure boundary in which the tube-to-tubesheet weld is no longer included, the effectiveness of the primary water chemistry program should be verified~~ A plant-specific AMP should be evaluated, along with the Water Chemistry program, to ensure ~~cracking is not occurring:~~that the program is capable of managing loss of material due to boric acid corrosion for the SG head base material. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

- ~~For plants with Alloy 600 steam generator tubes that have not been thermally treated and for which an alternate repair criteria such as C*, F* or W* has been permanently approved, the weld is no longer part of the pressure boundary and no plant specific aging management program is required;~~
- ~~For plants with Alloy 600 steam generator tubes that have not been thermally treated and for which there is no permanently approved alternate repair criteria such as C*, F* or W*, a plant-specific AMP is required;~~

- ~~For plants with Alloy 600TT steam generator tubes and for which an alternate repair criteria such as H* has been permanently approved, the weld is no longer part of the pressure boundary and no plant specific aging management program is required;~~
- ~~For plants with Alloy 600TT steam generator tubes and for which there is no alternate repair criteria such as H* permanently approved, a plant-specific AMP is required;~~
- ~~For plants with Alloy 690TT steam generator tubes with Alloy 690 tubesheet cladding, the water chemistry is sufficient, and no further action or plant-specific aging management program is required;~~
- ~~For plants with Alloy 690TT steam generator tubes and with Alloy 600 tubesheet cladding, either a plant-specific program or a rationale for why such a program is not needed is required.~~

~~The existing program relies on control of reactor water chemistry to mitigate cracking due to PWSCC. The GALL Report recommends that a plant-specific AMP be evaluated, along with the primary water chemistry program, because the existing primary water chemistry program may not be capable of mitigating cracking due to PWSCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).~~

3.1.2.2.~~12~~16 Cracking Due to ~~Fatigue~~Cyclic Loading

~~EPRI 1016596, *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines* (MRP-227-Rev. 0) identifies cracking due to fatigue as an aging effect that can occur for the lower flange weld in the core support barrel assembly, fuel alignment plate in the upper internals assembly, and core support plate lower support structure in PWR internals designed by Combustion Engineering. The GALL Report recommends that inspection for cracking in this component be performed if acceptable fatigue life cannot be demonstrated by TLAA through the period of extended operation as defined in 10 CFR 54.3.~~

~~*1.1.1.1.2 3.1.2.2.13 Cracking due to Stress Corrosion Cracking and Fatigue*~~

~~Cracking due to stress corrosion cracking and fatigue could occur in nickel alloy control rod guide tube assemblies, guide tube support pins exposed to reactor coolant, and neutron flux. The GALL Report, AMR Item IV.B2.RP-355, recommends further evaluation of a plant-specific AMP to ensure this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).~~

~~*1.1.1.1.3 3.1.2.2.14 Loss of Material due to Wear*~~

~~Loss of material due to wear could occur in nickel alloy control rod guide tube assemblies, guide tube support pins and in Zircaloy-4 incore instrumentation lower thimble tubes~~1.

Cracking due to cyclic loading could occur in BWR steel and SS welded connections between the re-routed control rod drive return line and the inlet piping system that delivers return line flow to the reactor pressure vessel, which are exposed to reactor coolant. Further evaluations of condition monitoring activities are recommended to ensure that cracking is detected before there is a loss of intended function. Periodic inspections in accordance with the recommendations in NUREG–0619, Section 8.2, are acceptable for the detection of cracking. Specifically, the welded connection that joins the re-routed control rod drive return line to the inlet piping system that returns flow to the reactor vessel should be inspected during each refueling outage. This inspection should use UT and include base metal to a distance of one-pipe-wall thickness or 0.5 inches, whichever is greater, on both sides of the weld. The inlet piping into which the control rod drive return line flow is connected should also be inspected by UT to a distance of at least one pipe diameter downstream of the welded connection. For other approaches, acceptance criteria are described in Appendix A.1 of this SRP-SLR Report. No condition monitoring activities are necessary if the control rod drive return line was removed.

2. Cracking due to cyclic loading could occur in BWR-2 steel (with or without SS cladding) CRD return line nozzles and their nozzle-to-vessel welds exposed to reactor coolant~~, and neutron flux. The GALL Report, AMR Items IV.B2.RP-356 and IV.B3.RP-357, recommends~~. Further evaluation of a plant-specific AMP is recommended to ensure that this aging effect is adequately managed because BWR-2 designs do not have a cut and capped CRD return line nozzle and thus may be more susceptible to cracking. Acceptance criteria are described in Appendix A.1 of this SRP-SLR.

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking or Intergranular Stress Corrosion Cracking

Cracking due to SCC and IGSCC could occur in BWR SS and nickel alloy piping, and piping components greater than or equal to 4 inches nominal pipe size (NPS); nozzle safe ends and associated welds; and CRD return line nozzle caps and the associated cap-to-nozzle welds or cap-to-safe end welds in BWR-3, BWR-4, BWR-5, and BWR-6 designs that are exposed to reactor coolant. GALL-SLR Report AMP XI.M2, “Water Chemistry,” is recommended to mitigate SCC and IGSCC, and augmented inspection activities are recommended in accordance with GALL-SLR Report AMP XI.M7, “BWR Stress Corrosion Cracking,” for condition monitoring. However, these programs may need to be augmented to manage the effects of cracking in dead-legs and other piping locations with stagnant flow where localized environmental conditions could exacerbate the mechanisms of SCC and IGSCC. Further evaluation ~~of a plant-specific AMP to ensure this aging effect is adequately managed.~~is recommended to identify any such locations and to evaluate the adequacy of the applicant’s proposed AMPs on a case-by-case basis to ensure that the intended functions of components in these locations will be maintained during the subsequent period of extended operation. Acceptance criteria are described in ~~Branch Technical Position RLSB-1 (~~Appendix A.1 of this SRP-~~LR).~~SLR.

~~3.1.2.2.15~~*3.1.2.2.18 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking*

Loss of material due to general (steel only), crevice, or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) can occur in steel and SS piping and piping components exposed to concrete. Concrete provides a high alkalinity environment that can mitigate the effects of loss of material for steel piping, thereby significantly reducing the corrosion rate. However, if water intrudes through the concrete, the pH can be reduced and ions that promote loss of material such as chlorides, which can penetrate the protective oxide layer created in the high alkalinity environment, can reach the surface of the metal. Carbonation can reduce the pH within concrete. The rate of carbonation is reduced by using concrete with a low water-to-cement ratio and low permeability. Concrete with low permeability also reduces the potential for the penetration of water. Adequate air entrainment improves the ability of the concrete to resist freezing and thawing cycles and therefore reduces the potential for cracking and intrusion of water. Intrusion of water can also bring bacteria to the surface of the metal, potentially resulting in microbiologically-induced corrosion in steel or SS. Cracking due to SCC, as well as pitting and crevice corrosion can occur due to halides present in the water that penetrates to the surface of the metal.

If the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with American Concrete Institute (ACI) 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to ground water. For SS components loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," is an acceptable method to manage these aging effects.

3.1.2.2.19 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

Loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 ppb. In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

Where oxygen levels are less than or equal to 100 ppb, GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M32, "One-Time Inspection," are acceptable methods to manage loss of material due to pitting and crevice corrosion. Where oxygen levels are greater than 100 ppb, GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," are acceptable methods to manage loss of material due to crevice corrosion. Where stagnant flow conditions exist, and oxygen levels are greater than 100 ppb and halides or sulfates levels are greater than 150 ppb, GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," are acceptable methods to manage loss of material due to pitting and crevice corrosion.

Where the pH is greater than or equal to 10.5 and the temperature is greater than or equal to 99 °C [210 °F], GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M32, "One-Time Inspection," are acceptable methods to manage loss of material due to loss of material due to microbiologically-induced corrosion. Where the pH is less than 10.5 and temperature is less than 99 °C [210 °F], GALL-SLR Report AMP XI.M2, "Water Chemistry," and

GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," are acceptable methods to manage loss of material due to microbiologically-induced corrosion.

3.1.2.2.20 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in ~~Branch Technical Position~~BTP IQMB-1 (Appendix A.2 of this SRP-~~LR~~SLR Report).

3.1.2.2.21 Ongoing Review of Operating Experience

Acceptance criteria are described in Appendix A.4, "Operating Experience for AMPs."

3~~AMR~~.1.2.3 Aging Management Review Results Not Consistent With or Not Addressed in the ~~GALL~~ Generic Aging Lessons Learned for Subsequent License Renewal Report

Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.1.2.4 Aging Management Programs

For those AMPs that will be used for aging management and are based on the program elements of an AMP in the GALL-SLR Report, the NRC reviewer performs an audit of ~~aging management programs~~ AMPs credited in the ~~LRA~~SLRA to confirm consistency with the GALL-SLR AMPs identified in the GALL-SLR Report, Chapters X, "Aging Management Programs That May Be Used to Demonstrate Acceptability of Time-Limited Aging Analyses in Accordance With Under 10 CFR 54.21(c) (1)(iii)" and XI~~.~~, "Aging Management Programs."

If the applicant identifies an exception to any of the program elements of the cited GALL-SLR Report AMP, the ~~LRA~~SLRA AMP should include a basis demonstrating how the criteria of 10 CFR 54.21(a)(3) would still be met. The reviewer should then confirm that the ~~LRA~~SLRA AMP with all exceptions would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the ~~LRA~~SLRA AMP, the reviewer identifies a difference between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP that should have been identified as an exception to the GALL-SLR Report AMP, the difference should be reviewed and properly dispositioned. The reviewer should document the disposition of all ~~LRA~~SLRA-defined exceptions and NRC staff-identified differences.

The ~~LRA~~SLRA should identify any enhancements that are needed to permit an existing licensee AMP to be declared consistent with the GALL-SLR Report AMP to which the licensee AMP is compared. The reviewer is to confirm both that the enhancement, when implemented, would allow the existing licensee AMP to be consistent with the GALL-SLR Report AMP and that the applicant has a commitment in the FSAR Supplement to implement the enhancement prior to the subsequent period of extended operation. The reviewer should document the disposition of all enhancements.

If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1.2.3 of this SRP-~~LR~~SLR Report).

3.1.2.5 ~~FSAR~~Final Safety Analysis Report Supplement

~~The summary description of~~ The programs and activities for managing the effects of aging for the subsequent period of extended operation described in the FSAR Supplement should be sufficiently comprehensive, such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects will be managed during the subsequent period of extended operation. The description should also contain any future aging management activities, including enhancements and commitments, to be completed before the subsequent period of extended operation. Table 3.0-1 of this SRP-~~LR~~SLR provides examples of the type of information to be included in the FSAR Supplement. Table 3.1-2 lists the programs that are applicable for this SRP-~~LR~~SLR subsection.

3.1.3 Review Procedures

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

3.1.3.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The applicant may reference the GALL-SLR Report in its ~~LRA~~SLRA, as appropriate, and demonstrate that the AMRs and AMPs at its facility are consistent with those reviewed and approved in the GALL-SLR Report. The reviewer should not conduct a re-review of the substance of the matters described in the GALL-SLR Report. If the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL-SLR Report, the reviewer should find acceptable the applicant's reference to the GALL-SLR Report in its ~~LRA.~~SLRA. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the ~~applicant has stated that the~~ applicable aging effects ~~and~~have been addressed based on the staff's review of industry and plant-specific operating experience ~~have been reviewed by the applicant and are evaluated in the GALL Report.~~.

Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL-SLR Report. Performance of this review requires the reviewer to confirm that the applicant has identified those aging effects for the reactor vessel, internals, and reactor coolant system components that are contained in the GALL-SLR Report as applicable to its plant.

3.1.3.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic review procedures defined in Subsection 3.1.3.1 need to be applied first for all of the AMRs and AMPs provided in this section. In addition, if the GALL-SLR Report AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply ~~as identified by the GALL Report~~ for each of the following aging effect/aging mechanism combinations.

3.1.3.2.1 Cumulative Fatigue Damage

Fatigue 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 NRC staff reviews the evaluation of this TLAA separately following the guidance in Section 4.3 of this SRP-~~LR~~SLR.

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

1. ~~The GALL Report recommends~~ An augmented program is recommended for the management of loss of material due to general, pitting, and crevice corrosion for steel PWR ~~steam generator~~SG shell assembly exposed to secondary feedwater and steam. The existing program relies on control of water chemistry to mitigate corrosion and ISI to detect loss of material. The extent and schedule of the existing ~~steam generator~~SG inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC IN 90-04, the program may not be sufficient to detect pitting and crevice corrosion, if general and pitting corrosion of the shell is known to exist. Therefore, ~~the GALL Report recommends~~an augmented inspection is recommended to manage this aging effect. Furthermore, ~~the GALL Report clarifies that~~ this issue is limited to Westinghouse Model 44 and 51 Steam Generators where a high-stress region exists at the shell to transition cone weld. Acceptance criteria are described in ~~Branch Technical Position~~ BTP RLSB-1 (Appendix A.1 of this SRP-~~LR).~~SLR Report). Loss of material due to general, pitting, and crevice corrosion could also occur for the steel top head enclosure (without cladding) top head nozzles ~~(~~[vent, top head spray or reactor core isolation cooling (RCIC~~,~~), and spare~~)~~] exposed to reactor coolant. The existing program relies on control of reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The reviewer verifies on a case-by-case basis that the applicant has proposed a program that will manage loss of material due to general, pitting and crevice corrosion by providing enhanced inspection and supplemental methods to detect loss of material and ensure that the component-intended function will be maintained during the subsequent period of extended operation.

2. ~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage the loss of material due to general, pitting, and crevice corrosion for the new transition cone closure weld generated in the steel PWR replacement recirculating steam generator transition cone shell exposed to secondary feedwater and steam. The existing program relies on control of reactor water chemistry to mitigate corrosion and on ISI to detect loss of material. The reviewer verifies on a case-by-case basis that the applicant has proposed an augmented program that will manage loss of material due to general, pitting, and crevice corrosion and ensure that the component-intended function will be maintained during the subsequent period of extended operation.

   The reviewer verifies that the applicant has described the surface condition and the resultant flow near the new transition cone closure weld (e.g., weld crown, ground flush, etc.) and how these parameters could affect the susceptibility of this weld to this aging effect, relative to that of the upper and lower transition welds. Based on this information, the reviewer verifies whether any additional aging management of the new transition weld is necessary. If additional aging management is necessary, the reviewer verifies whether the applicant has described an ~~aging management program~~AMP of the new transition cone closure weld (including examination frequency and technique) that will be effective in managing an aging effect, such as the loss of material due to general, pitting, and crevice corrosion during the subsequent period of extended operation for the new transition cone closure weld.

3.1.3.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

1. Neutron irradiation embrittlement 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 NRC staff reviews the evaluation of this TLAA following the guidance in Section 4.2 of this SRP-~~LR~~SLR.

2. Neutron irradiation embrittlement 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 ~~GALL Report recommends further evaluation of the~~NRC staff reviews the evaluation of this TLAA following the guidance in Section 4.2 of this SRP-SLR. Further evaluation is recommended for a reactor vessel materials surveillance program for the subsequent period of extended operation~~.~~ to monitor neutron embrittlement of the reactor vessel~~ is monitored by a reactor vessel materials surveillance program.~~. The reactor vessel surveillance program is plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance~~ capsules, and projected~~. A neutron fluence monitoring program is used to monitor the neutron fluence levels~~.~~ that are used as the time-dependent inputs for those reactor vessel neutron irradiation embrittlement TLAAs that are the subject of the topics in SRP-SLR Section 3.1.2.2.3, Subsection 1, and SRP-SLR Section 4.2.

   In accordance with 10 CFR Part 50, Appendix H, an applicant must submit its proposed capsule withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further NRC staff evaluation is required for ~~license renewal.~~SLR. The reviewer verifies on a case-by-case basis that the applicant has proposed an adequate reactor vessel materials surveillance program for the subsequent period of extended operation. The reviewer also verifies on a case-by-case basis that the applicant has proposed an acceptable neutron fluence monitoring AMP for the subsequent period of extended operation. Specific recommendations for ~~an~~ acceptable ~~AMP~~AMPs are provided in ~~Chapter~~ GALL-SLR Report AMP XI~~, Section~~ .M31~~ of the~~ , “Reactor Vessel Surveillance,” for reactor vessel material surveillance programs and GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring,” for neutron fluence monitoring programs.

~~2.~~3. ~~Ductility –~~ Reduction in Fracture Toughness for ~~Babcock and Wilcox~~B&W reactor internals 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 NRC staff reviews the evaluation of this TLAA following the guidance in Section 4.7 of this SRP-~~LR~~SLR consistent with the action item documented in the NRC staff’s safety evaluation for MRP-227, Revision 0.

3.1.3.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

1. ~~The GALL Report recommends that~~ A plant-specific AMP should be evaluated to manage cracking due to SCC and IGSCC in ~~stainless steel~~SS and nickel alloy BWR top head enclosure vessel flange leak detection lines. The reviewer reviews the applicant’s

proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

2. ~~The GALL Report recommends~~ An augmented program is recommended to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes for the management of cracking due to SCC and IGSCC of the ~~stainless steel~~SS BWR isolation condenser components. The existing program relies on control of reactor water chemistry to mitigate SCC and IGSCC and on ASME Section XI ISI to detect leakage. However, the existing program should be augmented to detect cracking due to SCC and IGSCC. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.1.3.2.5 Crack Growth Due to Cyclic Loading

~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage crack growth due to cyclic loading in reactor vessel shell forgings clad with ~~stainless steel~~SS using a high-heat-input welding process. Growth of intergranular separations (underclad cracks) in the heat affected zone under austenitic ~~stainless steel~~SS cladding is a TLAA to be evaluated for the subsequent period of extended operation for all the SA-508-Cl-2 forgings where the cladding was deposited with a high-heat-input welding process. The methodology for evaluating the underclad flaw should be consistent with the current well-established flaw evaluation procedure and criterion in the ASME Section XI Code. The SRP-~~LR~~SLR, Section 4.7~~, "Other Plant-Specific Time-Limited Aging Analysis,"~~ provides generic guidance for meeting the requirements of 10 CFR 54.21(c). The NRC staff reviews the evaluation of this TLAA separately following the guidance in Section 4.7 of this SRP-~~LR~~SLR Report.

3.1.3.2.6 Cracking Due to Stress Corrosion Cracking

1. ~~The GALL Report recommends that~~ A plant-specific AMP should be evaluated to manage cracking due to SCC in ~~stainless steel~~SS PWR reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

2. ~~The GALL Report recommends that~~ A plant-specific AMP should be evaluated to manage cracking due to SCC in CASS PWR Class 1 reactor coolant system piping~~, piping components,~~ and piping ~~elements~~components exposed to reactor coolant that do not meet the carbon and ferrite content guidelines of NUREG-0313. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.1.3.2.7 Cracking Due to Cyclic Loading

~~The GALL Report recommends~~ An augmented program for the management of cracking due to cyclic loading in steel and ~~stainless steel~~SS BWR isolation condenser components~~.~~ is recommended. The existing program relies on ASME Section XI ISI for detection. However, the inspection requirements should be augmented to detect cracking due to cyclic loading. An augmented program to include temperature and radioactivity monitoring of the shell-side water and eddy current testing of tubes is recommended to ensure that the component's intended function will be maintained during the subsequent period of extended operation. The reviewer verifies on a case-by-case basis that the applicant has proposed an augmented program that will detect cracking and ensure that the component-intended function will be maintained during the subsequent period of extended operation.

3.1.3.2.8 Loss of Material Due to Erosion

~~The GALL Report recommends~~ Further evaluation of a plant-specific AMP is recommended for the management of loss of material due to erosion of steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. ~~The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.~~

~~*1.1.1.1.4 3.1.3.2.9 Cracking due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking*~~

~~The GALL Report recommends further evaluation of cracking due to SCC and IASCC for inaccessible locations for Primary and Expansion PWR reactor vessel internal components if aging effects are identified for these components in accessible locations.~~ The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects~~consistent with the action item documented in the staff's safety evaluation for MRP-227, Revision 0.~~.

~~*1.1.1.1.5 3.1.3.2.10 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement; Change in Dimension due to Void Swelling; Loss of Preload due to Stress Relaxation; or Loss of Material due to Wear*~~

~~The GALL Report recommends further evaluation of loss of fracture toughness due to neutron irradiation embrittlement, change in dimension due to void swelling, loss of preload due to stress relaxation, or loss of material due to wear for inaccessible locations for Primary and Expansion~~ *3.1.3.2.9 Aging Management of PWR Reactor Vessel ~~internal~~Internals (Applicable to Subsequent License Renewal Periods Only)*

EPRI TR No. 1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)" (henceforth TR MRP-227-A, which may be accessed at ADAMS Accession Nos. ML12017A191 through ML12017A197 and ML12017A199), provides the industry's current aging management recommendations for the RVI components~~, if aging effects are~~ that are included in the design of a PWR facility. In this report, the EPRI MRP identified ~~for these~~ that the following aging mechanisms may be applicable to the design of the RVI components in ~~accessible locations.~~these types of facilities: (a) SCC, (b) IASCC, (c) fatigue, (d) wear, (e) neutron irradiation embrittlement, (f) thermal aging embrittlement, (g) void swelling and irradiation growth, or (h) thermal or irradiation-enhanced stress relaxation or irradiation enhanced creep. The methodology in TR MRP-227-A was approved by the NRC in a safety evaluation dated December 16, 2011 (ML11308A770), which includes those plant-specific applicant/licensee action items that a licensee or applicant applying the MRP-227-A report would need to address and resolve and apply to its licensing basis.

The EPRI MRP does not currently assess whether potential operations of Westinghouse-designed, B&W-designed and CE-designed reactors during a subsequent period of extended operation would have any impact on the existing susceptibility rankings and inspection categorizations for the RVI components in these designs, as defined in TR MRP-227-A or its applicable MRP issued background documents (e.g., TR MRP-191 for Westinghouse-designed or CE-designed RVI components or MRP-189 for B&W-designed components). Therefore, for SLRAs of PWR facilities, a plant-specific AMP for the RVI components is needed to demonstrate that the RVI components will be managed in accordance with the requirements of 10 CFR 54.21(a)(3) during a proposed subsequent period of extended operation. The reviewer reviews the adequacy of the applicant's ~~proposed program~~ AMP on a case-by-case basis ~~to ensure that an~~ against the criteria for plant-specific AMP program elements defined in Sections A.1.2.3.1 through A.1.2.3.10 of SRP-SLR Appendix A.1. The reviewer verifies that the applicant has defined both the type of performance monitoring, condition monitoring, preventative monitoring, or mitigative monitoring AMP that will be used for aging management of the RVI components and the specific program element criteria for the AMP that will be used to manage age-related effects in the RVI components during the SLR period.

If a plant-specific sampling-based condition monitoring program is proposed as the AMP for the components, the reviewer verifies that the applicant has appropriately identified (with adequate ~~program will be in place for the management of these~~ justification) the population of RVI components that are within the scope of the program, and the specific RVI components that will be inspected by the AMP. The reviewer also verifies that the applicant has appropriately identified the aging effects that will be monitored, the components in the inspection sample, and the inspection methods and frequency that will be applied to the components. The reviewer also verifies that program includes applicable inspection expansion criteria that will be applied under the program if inspections of the RVI components results in identification of relevant age-related aging effects or mechanisms. In addition, the reviewer verifies that the program includes appropriate acceptance criteria for evaluating the inspection results of the AMP and appropriate corrective action criteria that will be implemented if these acceptance criteria are not met. Applicant bases for resolving specific Technical Report or TR applicant/licensee action items will be within the scope of the NRC's review of the AMP. Refer to SRP-SLR Section 3.0 and SRP-SRP Appendix A.1 for additional information.

3.1.3.2.10 Loss of Material Due to Wear

1. Loss of material due to wear can occur in PWR CRD head penetration nozzles due to the interactions between the nozzle and the thermal sleeve centering pads of the nozzle. The applicant should perform a further evaluation to confirm the adequacy of a plant-specific AMP or analysis (with any necessary inspections) for management of the aging effect. The reviewer confirms that the applicant's plant-specific AMP for managing this aging effect meets the acceptance criteria that are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report). Alternatively, the reviewer confirms that loss of material due to wear does not affect the intended function(s) of CRD head penetration nozzles, consistent with the ~~action item documented in the staff's safety evaluation for MRP-227, Revision 0.~~CLB, if the applicant relies on an analysis for aging management. The reviewer also confirms whether inspections are necessary to ensure the adequacy of the analysis.

2. Loss of material due to wear can occur in the thermal sleeves of PWR CRD head penetration nozzles due to the interactions between the nozzle and the thermal sleeve. The applicant should perform a further evaluation to confirm the adequacy of a plant-specific AMP for management of the aging effect. The reviewer confirms that the applicant's plant-specific AMP for managing this aging

effect meets the acceptance criteria that are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

3.1.3.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

1. ~~The GALL Report recommends that~~ A plant-specific AMP should be evaluated, along with the primary water chemistry program, to manage cracking due to PWSCC in nickel alloy divider plate assemblies made of Alloy 600 and/or the associated Alloy 600 weld materials for ~~steam generators~~SGs with a similar design to that of Westinghouse Model 51. The effectiveness of the chemistry control program should be verified to ensure that cracking due to PWSCC is not occurring. The reviewer verifies the materials of construction of the ~~applicant's~~applicant’s SG divider plate assembly. If these materials are susceptible to cracking, the reviewer verifies that the applicant has evaluated the potential for cracking in the divider plate to propagate into other components (e.g., tubesheet cladding). If propagation into these other components is possible, the reviewer verifies if the applicant has described an inspection program (examination technique and frequency) for ensuring that no cracks are propagating into other items (e.g., tube sheet and channel head) that could challenge the integrity of those items. The reviewer reviews the applicant’s proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of this aging effect.

2. ~~The GALL Report recommends that~~ A plant-specific AMP should be evaluated, along with the primary water chemistry program, to manage cracking due to PWSCC in recirculating ~~steam generator~~SG nickel alloy tube-to-tubesheet welds exposed to reactor coolant. The effectiveness of the primary water chemistry program should be verified to ensure that cracking due to PWSCC is not occurring. The reviewer verifies the combination of materials of construction of the ~~steam generator~~SG tubes and tubesheet cladding and the classification of the tube-to-tubesheet weld. If this combination requires further evaluation, the reviewer reviews the applicant’s proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of this aging effect.

3.1.3.2.12 Cracking Due to ~~Fatigue~~Irradiation-Assisted Stress Corrosion Cracking

~~The GALL Report recommends further evaluation of cracking due to fatigue in the lower flange weld in the core support barrel assembly, fuel alignment plate in the upper internals assembly, and core support plate in the lower support structure in PWR internals designed by Combustion Engineering. The reviewer determines whether a TLAA has been performed for each component, consistent with the action item documented in the staff’s safety evaluation for MRP-227, Revision 0. If a TLAA has not been performed, the reviewer determines whether the applicant has performed an evaluation to identify the potential location and extent of fatigue cracking for each component consistent with the action item documented in the staff’s safety evaluation for MRP-227, Revision 0.~~

~~3.1.3.2.13 Cracking due to Stress~~ 1. Cracking due to IASCC can occur in BWR vessel internals made of nickel alloy and SS. The applicant should perform an evaluation to determine whether supplemental inspections are necessary in addition to the existing BWRVIP examination guidelines to adequately manage cracking due to IASCC for BWR vessel internals. This evaluation for supplemental inspections is based on neutron fluence and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions). The NRC staff reviews the applicant's evaluation to ensure that adequate supplemental inspections are identified and included in the applicant's BWR Vessel Internals Program as necessary for aging management of cracking due to IASCC. In addition, any necessary enhancements to the BWRVIP should be reviewed for adequate justification.

2. Cracking due to IASCC can occur in the BWR core shroud support plate access hole cover (welded or mechanical). The applicant should perform an evaluation to determine whether supplemental inspections are necessary in addition to the existing ISI to adequately manage cracking due to IASCC for this component for the subsequent period of extended operation. This evaluation is based on neutron fluence and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions). The NRC staff reviews the applicant's evaluation to ensure that adequate supplemental inspections are identified and included in the applicant's aging management for this component as necessary. In addition, any necessary enhancements to the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program should be reviewed for adequate justification.

3.1.3.2.13 Loss of Fracture Toughness Due to Neutron Irradiation or Thermal Aging Embrittlement

Loss of fracture toughness due to neutron irradiation embrittlement can occur in BWR vessel internals made of nickel alloy and SS. In addition, loss of fracture toughness due to neutron irradiation and thermal aging embrittlement can occur in BWR vessel internals made of CASS, PH martensitic SS (e.g., 15-5 and 17-4 PH steel) and martensitic SS (e.g., 403, 410, 431 steel).

The applicant should perform an evaluation to determine whether supplemental inspections are necessary in addition to the existing BWRVIP examination guidelines to adequately manage loss of fracture toughness for BWR vessel internals. This evaluation for supplemental inspections is based on neutron fluence, thermal aging susceptibility, fracture toughness, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions). The NRC staff reviews the applicant's evaluation to ensure that adequate supplemental inspections are identified and included in the applicant's BWRVIP as necessary for aging management of loss of fracture toughness. In addition, any necessary enhancements to the BWRVIP should be reviewed for adequate justification.

3.1.3.2.14 Loss of Preload Due to Thermal or Irradiation-Enhanced Stress Relaxation

GALL-SLR Report AMP XI.M9 of the GALL-SLR Report, "BWR Vessel Internals," manages loss of preload due to thermal or irradiation-enhanced stress relaxation in BWR core plate rim holddown bolts. The issue is applicable to BWR light water reactors that employ rim holddown bolts as the means for protecting the reactor's core plate from the consequences of lateral movement. The potential for such movement, if left unmanaged, could impact the ability of the reactor to be brought into a safe shutdown condition during an anticipated transient occurrence or during a postulated design-basis accident or seismic event. This issue is not applicable to BWR reactor designs that use wedges as the means of precluding lateral movement of the core plate because the wedges are fixed in place and are not subject to this type of aging effect and mechanism combination.

GALL-SLR Report AMP XI.M9 states that the inspections in BWRVIP TR No. BWRVIP-25, “BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25),” is used to manage loss of preload due to thermal or irradiation-enhanced stress relaxation in BWR designs with core plate rim holddown bolts. However, in initial LRAs, some applicants have identified that the inspection bases for managing loss of preload in TR No. BWRVIP-25 may not be capable of gaining access to the rim holddown bolts or are not sufficient to detect loss of preload on the components. For applicants that have identified this issue in their past LRAs, the applicants have committed to modifying the plant design to install wedges in the core plate designs or to submitting an inspection plan, with a supporting core plate rim holddown bolt preload analysis for NRC approval at least 2 years prior to entering the subsequent period of extended operation for the facility.

For SLRAs that apply to BWRs with core plate rim holddown bolts, the reviewer assesses whether the SLRA has included an enhanced augmented inspection basis for plants’ core plate rim holddown bolts and has justified the augmented inspection basis that will be applied to the components, along with a supporting loss of preload analysis that supports the augmented inspection method and frequency that will be applied to the bolts. If an existing NRC-approved analysis for the bolts exists in the CLB and conforms to the definition of a TLAA, the reviewer assesses whether the applicant has identified the analysis as a TLAA for the SLRA and has demonstrated why the analysis is acceptable in accordance with either 10 CFR 54.21(c)(1)(i), (ii), or (iii). Otherwise, if a new analysis will be performed to support an updated 80-year augmented inspection basis for the bolts for the subsequent period of extended operation, the NRC staff reviews the applicant’s augmented inspection and evaluation basis to determine whether the FSAR Supplement for the LRA has included a license commitment to submit both the inspection plan and the supporting loss of preload analysis to the NRC staff at least 2 years prior to entering into the subsequent period of extended operation for the facility.

3.1.3.2.15 Loss of Material Due to Boric Acid Corrosion ~~Cracking and Fatigue~~

~~The GALL Report recommends further evaluation of cracking due to stress corrosion cracking and fatigue in the nickel alloy control rod guide tube assemblies, guide tube support pins exposed to reactor coolant, and neutron flux.~~A plant-specific AMP should be evaluated, along with the Water Chemistry program, to adequately manage loss of material due to boric acid corrosion for the steel base material of the SG head. The reviewer should review the plant-specific program to ensure that the program is capable of managing loss of material due to boric acid corrosion for the steam generator head base material. If the channel head cladding is compromised or steel base material is corroded, the reviewer assesses whether additional analytical evaluations or inspections are necessary in order to ensure that the potential loss of material in the SG head will not affect the integrity of the component.

3.1.3.2.16 Cracking Due to Cyclic Loading

1. As discussed in NUREG–0619, rerouting the control rod drive return line was a measure taken by some licensees to prevent high cyclic thermal loading that had led to cracking of the control rod drive return line nozzles and the reactor pressure vessel wall in BWRs. As a result, in response to NRC Generic Letter (GL) 80-95, some BWR licensees cut and capped the control rod drive return line nozzle and rerouted the return line to an inlet piping system that delivers the return line flow to the reactor pressure vessel (RPV).

While this approach eliminated the thermal gradients in the control rod drive return line nozzle in the reactor pressure vessel, it introduced lower magnitude thermal gradients at the welded connection between the rerouted control rod drive return line piping and the inlet piping system. Section 8.2 of NUREG–0619 recommends periodic inspections of this welded connection to detect potential cracking caused by the cyclical loads from these thermal gradients.

The reviewer evaluates the adequacy of the applicant's condition monitoring activities to ensure that cracking will be detected before there is a loss of intended function at this welded connection. The reviewer either confirms that the applicant will follow the recommendations in NUREG–0619, Section 8.2; or evaluates the applicant's proposed condition monitoring activities on a case-by-case basis.

The CRD return lines were eliminated from some of the newer-vintage BWR-4, BWR-5, and BWR-6 designs that were still under construction when NUREG–0619 was published. For these cases, the reviewer confirms that the plant configuration does not include a CRD return line.

Cracking due to cyclic loading could occur in BWR-2 steel with or without SS cladding control rod drive return line nozzles and their nozzle-to-vessel welds exposed to reactor coolant. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of ~~these aging effects consistent with the action item documented in the staff's safety evaluation for MRP-227, Revision 0~~this aging effect.

~~.~~

3.1.3.2.~~14~~ ~~Loss of Material~~17 Cracking Due to ~~Wear~~Stress Corrosion Cracking or Intergranular Stress Corrosion Cracking

~~The GALL Report recommends further evaluation~~A review is recommended of ~~loss of material~~plant-specific AMPs for managing cracking due to ~~wear~~ SCC and IGSCC in BWR SS and nickel alloy ~~control rod guide tube assemblies, guide tube support pins and~~ piping and piping components greater than or equal to 4 inches NPS; nozzle safe ends and associated welds; and CRD return line nozzle caps and the associated cap-to-nozzle welds or cap-to-safe end welds in ~~Zircaloy-4 incore instrumentation lower thimble tubes~~ BWR-3, BWR-4, BWR-5, and BWR-6 designs that are exposed to reactor coolant~~, and neutron flux.~~. Components in dead-legs and other piping locations with stagnant flow may be subject to localized environmental conditions that could exacerbate the mechanisms of SCC and IGSCC. The reviewer ensures that the applicant has identified any such locations and provided justification for the AMPs credited for managing this aging effect. The reviewer reviews the applicant's justification and proposed ~~program~~AMPs on a case~~-~~-by-case basis to ensure that ~~an adequate program will be in place for the management of these aging~~ the effects of aging will be adequately managed.

3.1.3.2.18 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking

For steel piping and piping components exposed to concrete, if the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with ~~the action item documented~~American Concrete Institute (ACI) 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in ~~the staff's safety evaluation for MRP-227, Revision 0~~NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to groundwater. For SS piping and piping components, loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice, or pitting corrosion, and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," is an acceptable method to manage these aging effects.

~~3.1.3.2.15~~The reviewer verifies that the concrete was specified to meet ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557. The reviewer should evaluate plant-specific operating experience to determine whether concrete degradation sufficient to allow water intrusion has occurred.

3.1.3.2.19 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

Loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 ppb. In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

The reviewer verifies the applicant's chemistry control parameters to determine whether GALL-SLR Report AMP XI.M2, "Water Chemistry," and a one-time inspection program is implemented (e.g., GALL-SLR Report AMP XI.M32, "One-Time Inspection") or GALL-SLR Report AMP XI.M2, "Water Chemistry," and a periodic inspection program is implemented (e.g., GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components") to manage loss of material.

3.1.3.2.20 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's AMPs for ~~license renewal~~SLR should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an ~~aging management review for license renewal.~~AMR for SLR. Nevertheless, the applicant has the 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 the applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR Supplement. If the applicant chooses alternative means, the branch responsible for quality assurance (QA) should be requested to review the applicant's proposal on a case-by-case basis.

3.1.3.~~3~~ ~~AMR~~2.21 Ongoing Review of Operating Experience

The applicant's AMPs should contain the element of operating experience. The reviewer verifies that the applicant has appropriate programs or processes for the ongoing review of both plant-specific and industry operating experience concerning age-related degradation and aging management. Such reviews are used to ensure that the AMPs are effective to manage the aging effects for which they are created. The AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Additional information is in Appendix A.4, "Operating Experience for AMPs."

In addition, the reviewer confirms that the applicant has provided an appropriate summary description of these activities in the FSAR supplement. An example description is under "Operating Experience" in Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems for SLR."

3.1.3.3 Aging Managing Review Results Not Consistent With or Not Addressed in the ~~GALL~~ Generic Aging Lessons Learned for Subsequent License Renewal Report

The reviewer should confirm that the applicant, in its ~~LRA~~SLRA, has identified applicable aging effects, listed the appropriate combination of materials and environments, and AMPs that will adequately manage the aging effects. The AMP credited by the applicant could be an AMP that is described and evaluated in the GALL-SLR Report or a plant-specific program. Review procedures are described in ~~Branch Technical Position~~BTP RSLB-1 (Appendix A.1 of this SRP~~-LR~~-SLR Report).

3.1.3.4 Aging Management Programs

The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL-SLR Report. If the applicant commits to an enhancement to make its ~~LRA~~SLRA AMP consistent with a GALL-SLR Report AMP, then the reviewer is to confirm that this enhancement, when implemented, will make the ~~LRA~~SLRA AMP consistent with the GALL-SLR Report AMP. If the applicant identifies, in the ~~LRA~~SLRA AMP, an exception to any of the program elements of the GALL-SLR Report AMP, the reviewer is to confirm that the ~~LRA~~SLRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3). If the reviewer identifies a difference, not identified by the ~~LRA~~SLRA, between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP, with which the ~~LRA~~SLRA claims to be consistent, the reviewer should confirm that the ~~LRA~~SLRA AMP with this difference satisfies 10 CFR 54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions, or differences. The AMPs evaluated in the GALL-SLR Report pertinent to the reactor vessel, internals, and reactor coolant system are summarized in Table 3.1-1 of this SRP-~~LR.~~SLR. The "~~Rev 2~~GALL-SLR Item" ~~(for 2010) and "Rev1 Item" (for 2005 counterpart) columns identify~~column identifies the AMR item numbers in the GALL-SLR Report, Chapter IV, presenting detailed information summarized by this row.

3.1.3.5 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer confirms that the applicant has provided in its FSAR supplement information equivalent to that in Table 3.0-1 for aging management of the reactor vessel, internals, and reactor coolant system. Table 3.1-2 lists the AMPs that are applicable for this SRP-~~LR~~SLR subsection. The reviewer also confirms that the applicant has provided information for

Subsection 3.1.3.3, “AMR Results Not Consistent with or Not Addressed in the GALL-SLR Report,” equivalent to that in Table 3.0-1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR Supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license conditions until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR Supplement without prior NRC approval, provided that the applicant evaluates each such change and finds it acceptable pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.

As noted in Table 3.0-1, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should confirm that the applicant has identified and committed in the ~~license renewal application~~SLRA to any future aging management activities, including enhancements and commitments to be completed before entering the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

3.1.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of this section, then an evaluation finding similar to the following text should be included in the NRC staff’s safety evaluation report:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has demonstrated that the aging effects associated with the reactor vessel, internals, and reactor coolant system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).
>
> The NRC staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the reactor vessel, internals and reactor coolant system, as required by 10 CFR 54.21(d).

3.1.5 Implementation

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

3.1.6 References

~~1. NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, March 2007.~~

~~2. NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

~~3.~~1. NEI. NEI 97-06, “Steam Generator Program Guidelines~~,”~~.” Revision 2~~,~~. Washington, DC: Nuclear Energy Institute~~,~~. September 2005.

~~4.~~2. NEI. NEI 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54~~—~~—The License Renewal Rule~~,”~~.” Revision 6. Washington, DC: Nuclear Energy Institute~~, Revision 6~~.

~~5.~~3. NRC. Information Notice 90-04, “Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. January 26, 1990.

~~6.~~4. NRC. NUREG~~-~~–0313~~, Rev. 2~~, “Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping~~,”~~.” Revision 2. Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. January 1988.

~~7.~~5. EPRI. EPRI 1013706, “PWR Steam Generator Examination Guidelines~~, Rev.~~. Revision 7~~,~~”. Palo Alto, California: Electric Power Research Institute~~,~~. October 2007.

~~8.~~6. NRC. Regulatory Guide 1.121, “Bases for Plugging Degraded PWR Steam Generator Tubes (for Comment~~),”~~).” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. May 1976.

~~9.~~7. NRC. Generic Letter 95-05, “Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. August 3, 1995.

~~10.~~8. NRC. Information Notice 90-10, “Primary Water Stress Corrosion Cracking (PWSCC) of Inconel 600~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. February 23, 1990.

~~11.~~9. NRC. Information Notice 90-30, “Ultrasonic Inspection Techniques for Dissimilar Metal Welds~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. May 1, 1990.

~~12.~~10. NRC. Generic Letter 89-08, “Erosion/Corrosion-Induced Pipe Wall Thinning~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. May 2, 1989.

~~13.~~11. EPRI. NSAC-202L-R3, “Recommendations for an Effective Flow-accelerated Corrosion Program~~,”~~.” Palo Alto, California: Electric Power Research Institute~~,~~. April 1999.

~~14.~~12. NRC. Information Notice 96-11, “Ingress of Demineralizer Resins Increase Potential for Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. February 14, 1996.

~~15.~~13. EPRI. BWRVIP~~-~~–190 (EPRI 1016579), *BWR Vessel and Internals Project: BWR Water Chemistry Guidelines-2008 Revision*~~,~~. Palo Alto, California: Electric Power Research Institute~~, Palo Alto, CA,~~. October 2008

~~16.~~14. EPRI. NP~~-~~–5769, “Degradation and Failure of Bolting in Nuclear Power Plants~~,”~~.” Volumes 1 and 2~~,~~. Palo Alto, California: Electric Power Research Institute~~, Palo Alto, CA,~~. April 1988.

~~17.~~15. EPRI. TR 1014986, “PWR Primary Water Chemistry Guidelines~~,”~~.” Revision 6~~,~~. Volumes 1 and 2~~,~~. Palo Alto, California: Electric Power Research Institute~~, Palo Alto, CA,~~. December 2007.

~~18.~~16. NRC. Generic Letter 88-01, “NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. January 25, 1988.

~~19.~~17. NRC. Generic Letter 97-01, “Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. April 1, 1997.

~~20.~~18. NRC. Information Notice 97-46, “Unisolable Crack in High-Pressure Injection Piping~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. July 9, 1997.

~~21.~~19. NRC. Regulatory Guide 1.99, ~~Rev. 2,~~ “Radiation Embrittlement of Reactor Vessel Materials~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. May 1988.

~~22.~~20. NRC. NUREG~~-~~–0619, “BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. November 1980.

~~23.~~21. NRC. NUREG~~-~~–1339, “Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants~~,” Richard E. Johnson,~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. June 1990.

~~24.~~22. EPRI. TR-104213, “Bolted Joint Maintenance & Application Guide, Electric Power Research Institute~~,”~~.” Palo Alto, ~~CA,~~California: Electric Power Research Institute. December 1995.

~~25.~~23. Dave Modeen. NEI Letter ~~dated Dec.~~(December 11~~, 1998, Dave Modeen~~) to Gus Lainas, “Responses to NRC Requests for Additional Information (RAIs) on GL 97-01.” Washington, DC: Nuclear Energy Institute. 1998.

~~26.~~24. EPRI. TR 1016555, “PWR Secondary Water Chemistry Guidelines–Revision 7~~,” Electric Power Research Institute,~~.” Palo Alto, ~~CA,~~California: Electric Power Research Institute. February 2009.

~~27.~~25. NRC. Information Notice 91-19, “Steam Generator Feedwater Distribution Piping Damage~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. March 12, 1991.

~~28.~~26. EPRI ~~1016596~~. TR 1022863, “Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines~~,”~~ (MRP-227~~, Revision 0, Electric Power Research Institute,~~-A).” Palo Alto, ~~CA,~~California: Electric Power Research Institute. December ~~2008~~2011.

~~29.~~27. ~~Topical Report,~~Entergy Operations, Inc. “Demonstration of the Management of Aging Effects for the Reactor Vessel Internals~~,”~~.” Topical Report BAW-2248A~~,~~. Russellville, Arkansas: Entergy Operations, Inc. March 2000.

~~30.~~28. EPRI. TR-1014982, “Divider Plate Cracking in Steam Generators - Results of Phase 1: Analysis of Primary Water Stress Corrosion Cracking and Mechanical Fatigue in the

Alloy 600 Stub Runner to Divider Plate Weld Material~~,”~~.” Palo Alto, California: Electric Power Research Institute~~, Palo Alto, CA,~~. June 2007.

29. Dominion Nuclear Connecticut, Inc. Letter (July 13) to NRC, Dominion Nuclear Connecticut, Inc. Millstone Power Station Unit 3 Results of the Reactor Pressure Vessel Head Inspections Required by NRC Order EA-03-009. 2007.

30. Southern Company. Letter (June 21) to the NRC, Vogtle Electric Generating Plant - Unit 2 Results of Reactor Pressure Vessel Head Inspections Required by First Revised Order EA-03-009. Atlanta, Georgia: Southern Company. 2007.

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~1~~M	~~BWR/PWR~~ 1	~~High strength, low-alloy steel top head closure stud assembly exposed to air with potential for reactor coolant leakage~~BWR/PWR	~~Cumulative fatigue damage due to fatigue~~Steel reactor vessel closure flange assembly components exposed to air with potential for reactor coolant leakage	~~Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.A1.RP-201~~ ~~IV.A2.RP-54~~ Yes (SRP-SLR Section 3.1.2.2.1)	~~N/A~~ IV.A1.RP-201 IV.A2~~-4(R-73)~~.RP-54
~~2~~M	~~PWR~~2	~~Nickel alloy tubes and sleeves exposed to reactor coolant and secondary feedwater/steam~~PWR	~~Cumulative fatigue damage due to fatigue~~Nickel alloy tubes and sleeves exposed to reactor coolant, secondary feedwater/steam	~~Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.D1.R-46~~ ~~IV.D2.R-46~~ Yes (SRP-SLR Section 3.1.2.2.1)	IV.D1~~-21(~~.R-46~~)~~ IV.D2~~-15(~~.R-46~~)~~
~~3~~M	~~BWR/PWR~~ 3	~~Stainless steel or nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux~~BWR/PWR	~~Cumulative fatigue damage due to fatigue~~Stainless steel, nickel alloy reactor vessel internal components exposed to reactor coolant, neutron flux	~~Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage:	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.B1.R-53~~ ~~IV.B2.RP-303~~ ~~IV.B3.RP-339~~ ~~IV.B4.R-53~~	IV.B1~~-14(~~.R-53~~)~~ IV.B2~~-31(R-53)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				cracking due to fatigue, cyclical loading		~~IV.B3.RP-389~~ ~~IV.B3.RP-390~~ ~~IV.B3.RP-391~~ Yes (SRP-SLR Section 3.1.2.2.1)	.RP-303 IV.B3~~-24(R-53)~~ .RP-339 IV.B4~~-37(~~.R-53~~)~~ ~~N/A~~ ~~N/A~~ ~~N/A~~
~~4~~M	~~BWR/PWR~~4	~~Steel pressure vessel support skirt and attachment welds~~BWR/PWR	~~Cumulative fatigue damage due to fatigue~~Steel pressure vessel support skirt and attachment welds	~~Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.A1.R-70~~ ~~IV.A2.R-70~~ Yes (SRP-SLR Section 3.1.2.2.1)	IV.A1~~-6(~~.R-70~~)~~ IV.A2~~-20(~~.R-70~~)~~
~~5~~M	~~PWR~~5	~~Steel, stainless steel, or steel (with stainless steel or nickel alloy cladding) steam generator components,~~	~~Cumulative fatigue damage due to fatigue~~Steel, stainless steel, steel (with stainless steel or nickel alloy cladding) steam generator components,	~~Fatigue is a TLAA evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR~~	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.C2.R-13~~ ~~IV.C2.R-18~~ ~~IV.D1.R-33~~ ~~IV.D2.R-33~~	IV.C2~~-23(~~.R-13~~)~~ IV.C2~~-10(~~.R-18~~)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~pressurizer relief tank components or piping components or bolting~~PWR	pressurizer relief tank components, piping components, bolting	~~54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading		Yes (SRP-SLR Section 3.1.2.2.1)	IV.D1-~~11(~~.R-33~~)~~ IV.D2-~~10(~~.R-33~~)~~
~~6~~M	~~BWR~~6	~~Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor coolant pressure boundary components: piping, piping components, and piping elements exposed to reactor coolant~~BWR	~~Cumulative fatigue damage due to fatigue~~Steel (with or without nickel-alloy or stainless steel cladding), stainless steel; nickel alloy reactor coolant pressure boundary components: piping, piping components; other pressure retaining components exposed to reactor coolant	~~Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed. (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.C1.R-220~~ Yes (SRP-SLR, Section 3.1.2.2.1)	IV.C1-~~15(~~.R-220~~)~~
~~7~~M	~~BWR~~7	~~Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor vessel~~	~~Cumulative fatigue damage due to fatigue~~Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor	~~Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be~~	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.A1.R-04~~ Yes (SRP-SLR, Section 3.1.2.2.1)	IV.A1-~~7(~~.R-04~~)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~components: flanges; nozzles; penetrations; safe ends; thermal sleeves;vessel shells, heads and welds exposed to reactor coolant~~BWR	vessel components: nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant	~~addressed. (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading			
8M	~~PWR~~8	~~Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy steam generator components exposed to reactor coolant~~PWR	~~Cumulative fatigue damage due to fatigue~~Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy steam generator components exposed to reactor coolant	~~Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed. (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.D1.R-221~~ ~~IV.D2.R-222~~ Yes (SRP-SLR, Section 3.1.2.2.1)	IV.D1~~-8(~~.R-221~~)~~ IV.D2~~-3(~~.R-222~~)~~
9M	~~PWR~~9	~~Steel (with or without nickel-alloy or stainless steel cladding),~~	~~Cumulative fatigue damage due to fatigue~~Steel (with or without nickel-alloy or	~~Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1~~	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section	~~IV.C2.R-223~~ Yes (SRP-SLR,	IV.C2~~-25(~~.R-223~~)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~stainless steel; nickel alloy RCPB piping; flanges; nozzles & safe ends; pressurizer shell heads & welds; heater sheaths & sleeves; penetrations; thermal sleeves exposed to reactor coolant~~PWR	stainless steel cladding), stainless steel; nickel alloy reactor coolant pressure boundary piping, piping components; other pressure retaining components exposed to reactor coolant	~~components environmental effects on fatigue are to be addressed. (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	4.3 "Metal Fatigue"	Section 3.1.2.2.1)	
~~10~~M	~~PWR~~10	~~Steel (with or without nickel-alloy or stainless steel cladding), stainless steel; nickel alloy reactor vessel flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds exposed to~~	~~Cumulative fatigue damage due to fatigue~~Steel (with or without nickel-alloy or stainless steel cladding), stainless steel, or nickel alloy reactor vessel components: nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant	~~Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed. (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.A2.R-219~~ Yes (SRP-SLR, Section 3.1.2.2.1)	IV.A2~~-21(~~.R-219~~)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~reactor coolant~~PWR					
~~11~~M	~~BWR~~11	~~Steel or stainless steel pump and valve closure bolting exposed to high temperatures and thermal cycles~~BWR	~~Cumulative fatigue damage due to fatigue~~Steel or stainless steel pump and valve closure bolting exposed to high temperatures and thermal cycles	~~Fatigue is a TLAA evaluated for the period of extended operation; check ASME Code limits for allowable cycles (less than 7000 cycles) of thermal stress range. (SRP Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))~~Cumulative fatigue damage: cracking due to fatigue, cyclical loading	~~Yes, TLAA (See subsection 3.1.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~IV.C1.RP-44~~ Yes (SRP-SLR Section 3.1.2.2.1)	IV.C1~~-11(R-28)~~.RP-44
~~12~~M	~~PWR~~12	~~Steel steam generator components: upper and lower shells, transition cone; new transition cone closure weld exposed to secondary feedwater or steam~~PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel steam generator components: upper and lower shells, transition cone; new transition cone closure weld exposed to secondary feedwater or steam	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry," and, for Westinghouse Model 44 and 51 S/G, if corrosion of the shell is found, additional inspection procedures~~	~~Yes, detection of aging effects is to be evaluated (See subsection 3.1.2.2.2.1 and 3.1.2.2.2.2)~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,"	~~IV.D1.RP-368~~ Yes (SRP-SLR Sections 3.1.2.2.2.1 and 3.1.2.2.2.2)	IV.D1~~-12(R-34)~~.RP-368

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~are developed~~Loss of material due to general, pitting, crevice corrosion	and AMP XI.M2, "Water Chemistry"		
~~13~~M	~~BWR/PWR~~ 13	~~Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds exposed to reactor coolant and neutron flux~~BWR/PWR	~~Loss of fracture toughness due to neutron irradiation embrittlement~~Steel (with or without stainless steel or nickel alloy cladding) reactor vessel beltline shell, nozzle, and weld components exposed to reactor coolant and neutron flux	~~TLAA is to be evaluated in accordance with Appendix G of 10 CFR Part 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations~~Loss of fracture toughness due to neutron irradiation embrittlement	~~Yes, TLAA (See subsection 3.1.2.2.3.1)~~TLAA, SRP-SLR Section 4.2 "Reactor Vessel Neutron Embrittlement"	~~IV.A1.R-62~~ ~~IV.A1.R-67~~ ~~IV.A2.R-81~~ ~~IV.A2.R-84~~ Yes (SRP-SLR Section 3.1.2.2.3.1)	IV.A1~~-13(~~.R-62~~)~~ ~~IV.A1-4(R-67)~~ IV.A2~~-16(R-81)~~ ~~IV.A2-23(~~.R-84~~)~~
~~14~~M	~~BWR/PWR~~ 14	~~Steel (with or without cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles~~BWR/PWR	~~Loss of fracture toughness due to neutron irradiation embrittlement~~Steel (with or without cladding) reactor vessel beltline shell, nozzle, and weld components; exposed to reactor coolant and neutron flux	~~Chapter XI.M31, "Reactor Vessel Surveillance"~~Loss of fracture toughness due to neutron irradiation embrittlement	~~Yes, plant specific or integrated surveillance program (See subsection 3.1.2.2.3.2)~~AMP XI.M31, "Reactor Vessel Material Surveillance," and X.M2, "Neutron Fluence Monitoring"	~~IV.A1.RP-227~~ ~~IV.A2.RP-228~~ ~~IV.A2.RP-229~~ Yes (SRP-SLR Section 3.1.2.2.3.2)	IV.A1~~-14(R-63)~~ .RP-227 IV.A2~~-17(R-82)~~ ~~IV.A2-24(R-86)~~ .RP-229

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~15~~M	~~PWR~~15	~~Stainless steel and nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux~~PWR	~~Reduction in ductility and fracture toughness due to neutron irradiation~~Stainless steel Babcock & Wilcox (including CASS, martensitic SS, and PH SS) and nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux	~~Ductility -~~ Reduction in fracture toughness ~~is a TLAA~~due to ~~be evaluated for the period of extended operation. See the SRP, Section 4.7, "Other Plant-Specific TLAAs," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).~~neutron irradiation	~~Yes, TLAA (See subsection 3.1.2.2.3.3)~~TLAA, SRP-SLR Section 4.7 "Other Plant-Specific TLAAs"	~~IV.B4.RP-376~~ Yes (SRP-SLR Section 3.1.2.2.3.3)	~~N/A~~ IV.B4.RP-376
~~16~~M	~~BWR~~16	~~Stainless steel and nickel alloy top head enclosure vessel flange leak detection line~~BWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking~~Stainless steel and nickel alloy top head enclosure vessel flange leak detection line	~~A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	~~Yes,~~ Plant-specific ~~(See subsection 3.1.2.2.4.1)~~aging management program	~~IV.A1.R-61~~ Yes (SRP-SLR Section 3.1.2.2.4.1)	IV.A1~~-10(~~.R-61~~)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~17~~M	~~BWR~~17	~~Stainless steel isolation condenser components exposed to reactor coolant~~BWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking~~Stainless steel isolation condenser components exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry" for BWR water, and a plant-specific verification program~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	~~Yes, detection of aging effects is to be evaluated (See subsection 3.1.2.2.4.2)~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.C1.R-15~~ Yes (SRP-SLR Section 3.1.2.2.4.2)	IV.C1~~-4(~~.R-15~~)~~
~~18~~M	~~PWR~~18	~~Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process exposed to reactor coolant~~PWR	~~Crack growth due to cyclic loading~~Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process exposed to reactor coolant	~~Growth of intergranular separations is a TLAA evaluated for the period of extended operation. The Standard Review Plan, Section 4.7, "Other Plant-Specific Time-Limited Aging Analysis," provides guidance for meeting the requirements of 10 CFR 54.21(c).~~Crack growth due to cyclic loading	~~Yes, TLAA (See subsection 3.1.2.2.5)~~TLAA, SRP-SLR Section 4.7 "Other Plant-Specific TLAAs"	~~IV.A2.R-85~~ Yes (SRP-SLR Section 3.1.2.2.5)	IV.A2~~-22(~~.R-85~~)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~19~~M	~~PWR~~19	~~Stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes (external to reactor vessel)~~PWR	~~Cracking due to stress corrosion cracking~~Stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes (external to reactor vessel)	~~A plant-specific aging management program is to be evaluated~~Cracking due to stress corrosion cracking	~~Yes,~~ Plant-specific ~~(See subsection 3.1.2.2.6.1)~~aging management program	~~IV.A2.R-74~~ ~~IV.A2.RP-154~~ Yes (SRP-SLR Section 3.1.2.2.6.1)	IV.A2~~-5(~~.R-74~~)~~ IV.A2~~-1(~~.RP-~~13)~~ 154
~~20~~M	~~PWR~~20	~~Cast austenitic stainless steel Class 1 piping, piping components, and piping elements exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking~~Cast austenitic stainless steel Class 1 piping, piping components exposed to reactor coolant	~~Chapter XI.M2, "Water Chemistry" and, for CASS components that do not meet the NUREG-0313 guidelines, a plant specific aging management program~~Cracking due to stress corrosion cracking	~~Yes,~~AMP XI.M2, "Water Chemistry" and plant-specific ~~(See subsection 3.1.2.2.6.2)~~aging management program	~~IV.C2.R-05~~ Yes (SRP-SLR Section 3.1.2.2.6.2)	IV.C2~~-3(~~.R-05~~)~~
~~21~~M	~~BWR~~21	~~Steel and stainless steel isolation condenser components exposed to reactor coolant~~BWR	~~Cracking due to cyclic loading~~Steel and stainless steel isolation condenser components exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components The ISI program is to be augmented by a plant-specific verification~~	~~Yes, detection of aging effects is to be evaluated (See subsection 3.1.2.2.7)~~AMP XI.M1, "ASME Section XI Inservice Inspection,	~~IV.C1.R-225~~ Yes (SRP-SLR Section 3.1.2.2.7)	IV.C1~~-5(~~.R-225~~)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~program~~Cracking due to cyclic loading	Subsections IWB, IWC, and IWD."		
~~22~~M	~~PWR~~22	~~Steel steam generator feedwater impingement plate and support exposed to secondary feedwater~~PWR	~~Loss of material due to erosion~~Steel steam generator feedwater impingement plate and support exposed to secondary feedwater	~~A plant-specific aging management program is to be evaluated~~Loss of material due to erosion	~~Yes,~~ Plant-specific ~~(See subsection 3.1.2.2.8)~~aging management program	~~IV.D1.R-39~~ Yes (SRP-SLR Section 3.1.2.2.8)	IV.D1~~-13(~~.R-39~~)~~
~~23~~M	~~PWR~~25	~~Stainless steel or nickel alloy PWR reactor vessel internal components (inaccessible locations) exposed to reactor coolant and neutron flux~~PWR	~~Cracking due to stress corrosion cracking, and irradiation-assisted stress corrosion cracking~~Steel (with nickel-alloy cladding) or nickel alloy steam generator primary side components: divider plate and tube-to-tube sheet welds exposed to reactor coolant	~~Chapter XI.M16A, "PWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"~~Cracking due to primary water stress corrosion cracking	~~Yes, if accessible Primary, Expansion or Existing program components indicate aging effects that need management (See subsection 3.1.2.2.9)~~AMP XI.M2, "Water Chemistry" and plant-specific aging management program	~~IV.B2.RP-268~~ ~~IV.B3.RP-309~~ ~~IV.B4.RP-238~~ Yes (SRP-SLR Sections 3.1.2.2.11.1 for divider plates and 3.1.2.2.11.2 for tube to tube sheet welds)	~~N/A~~ ~~N/A~~ ~~N/A~~ IV.D1.RP-367 IV.D1.RP-385 IV.D2.RP-185

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~24~~D	~~PWR~~28	~~Stainless steel or nickel alloy PWR reactor vessel internal components (inaccessible locations) exposed to reactor coolant and neutron flux~~	~~Loss of fracture toughness due to neutron irradiation embrittlement; or changes in dimension due to void swelling; or loss of preload due to thermal and irradiation enhanced stress relaxation; or loss of material due to wear~~	~~Chapter XI.M16A, "PWR Vessel Internals"~~	~~Yes, if accessible Primary, Expansion or Existing program components indicate aging effects that need management (See subsection 3.1.2.2.10)~~	~~IV.B2.RP-269~~ ~~IV.B3.RP-311~~ ~~IV.B4.RP-239~~	~~N/A~~ ~~N/A~~ ~~N/A~~
~~25~~M	~~PWR~~29	~~Steel (with nickel-alloy cladding) or nickel alloy steam generator primary side components: divider plate and tube-to-tube sheet welds exposed to reactor coolant~~BWR	~~Cracking due to primary water stress corrosion cracking~~Nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant	~~Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	~~Yes, plant-specific (See subsections 3.1.2.2.11.1 and 3.1.2.2.11.2)~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.D1.RP-367~~ ~~IV.D1.RP-385~~ ~~IV.D2.RP-185~~ Yes (SRP-SLR Section 3.1.2.2.12.2)	IV.~~D1-6(RP-21)~~ ~~N/A~~ ~~IV.D2-4(~~B1.R-~~35)~~94
~~26~~	~~PWR~~30	~~Stainless steel Combustion Engineering core support barrel assembly: lower flange weld~~	~~Cracking due to fatigue~~Stainless steel, nickel alloy penetration: drain line exposed to reactor coolant	~~Chapter XI.M16A, "PWR Vessel Internals," and Chapter XI.M2, "Water Chemistry," if fatigue life cannot be~~	~~Yes, evaluate to determine the potential locations and extent of fatigue cracking (See~~	~~IV.B3.RP-333~~ ~~IV.B3.RP-338~~ ~~IV.B3.RP-343~~ No	~~N/A~~ IV.A1.RP-371

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~exposed to reactor coolant and neutron flux; Upper internals assembly: fuel alignment plate (applicable to plants with core shrouds assembled with full height shroud plates) exposed to reactor coolant and neutron flux; Lower support structure: core support plate (applicable to plants with a core support plate) exposed to reactor coolant and neutron flux~~BWR		~~confirmed by TLAA~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	~~subsection 3.1.2.2.12)~~ AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"		
~~27~~	~~PWR~~31	~~Nickel alloy Westinghouse control rod guide tube assemblies, guide tube support pins exposed to~~	~~Cracking due to stress corrosion cracking and fatigue~~Steel and stainless steel isolation condenser components exposed to reactor coolant	~~A plant-specific aging management program is to be evaluated~~Loss of material due to general (steel only), pitting, crevice corrosion	~~Yes, plant-specific (See subsection 3.1.2.2.13)~~AMP XI.M1, "ASME Section XI Inservice	~~IV.B2.RP-355~~ No	~~N/A~~ IV.C1.RP-39

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~reactor coolant and neutron flux~~BWR			Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"		
~~28~~D	~~PWR~~32	~~Nickel alloy Westinghouse control rod guide tube assemblies, guide tube support pins, and Zircaloy-4 Combustion Engineering incore instrumentation thimble tubes exposed to reactor coolant and neutron flux~~	~~Loss of material due to wear~~	~~A plant-specific aging management program is to be evaluated~~	~~Yes, plant-specific (See subsection 3.1.2.2.14)~~	~~IV.B2.RP-356~~ ~~IV.B3.RP-357~~	~~N/A~~ ~~N/A~~
~~29~~M	~~BWR~~33	~~Nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking~~Stainless steel, steel with stainless steel cladding Class 1 reactor coolant pressure	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry," and for BWRs with a crevice in the access hole covers, augmented inspection~~	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.B1.R-94~~ No	~~IV.B1-5(R-94)~~ IV.C2.R-09 IV.C2.R-217 IV.C2.R-30 IV.C2.RP

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			boundary components exposed to reactor coolant	~~using UT or other acceptable techniques~~Cracking due to stress corrosion cracking			-344 IV.D1.RP-232
~~30~~M	~~BWR~~34	~~Stainless steel or nickel alloy penetration: drain line exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading~~Stainless steel, steel with stainless steel cladding pressurizer relief tank (tank shell and heads, flanges, nozzles) exposed to treated borated water >60°C (>140°F)	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.A1.RP-371~~ No	IV.~~A1-5(R-69)~~ C2.RP-231
~~31~~M	~~BWR~~35	~~Steel and stainless steel isolation condenser components exposed to reactor coolant~~PWR	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~Stainless steel, steel with stainless steel cladding reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry"~~Cracking due to cyclic loading	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	~~IV.C1.RP-39~~ No	IV.~~C1-6(~~C2.R-~~16)~~ 56

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~32~~M	~~PWR~~36	~~Stainless steel, nickel alloy, or CASS reactor vessel internals, core support structure, exposed to reactor coolant and neutron flux~~PWR	~~Cracking, or loss of material due to wear~~Steel, stainless steel pressurizer integral support exposed to air with metal temperature up to 288°C (550°F)	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"~~Cracking due to cyclic loading	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	~~IV.B2.RP-382~~ ~~IV.B3.RP-382~~ ~~IV.B4.RP-382~~ No	IV.~~B2-26(~~C2.R-~~142)~~ ~~IV.B3-22(R-170)~~ ~~IV.B4-42(R-179)~~ 19
~~33~~M	~~PWR~~37	~~Stainless steel, steel with stainless steel cladding Class 1 reactor coolant pressure boundary components exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking~~Steel reactor vessel flange	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for ASME components, and Chapter XI.M2, "Water Chemistry"~~ Loss of material due to wear	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	~~IV.C2.R-09~~ ~~IV.C2.R-217~~ ~~IV.C2.R-30~~ ~~IV.C2.RP-344~~ ~~IV.D1.RP-232~~ No	IV.~~C2-5(~~A2.R-~~09)~~ ~~IV.C2-20(R-217)~~ ~~IV.C2-27(R-30)~~ ~~IV.C2-2(R-07)~~ ~~IV.D1-1(R-07)~~ 87
~~34~~M	~~PWR~~38	~~Stainless steel, steel with stainless steel cladding pressurizer relief~~	~~Cracking due to stress corrosion cracking~~Cast austenitic stainless steel Class 1 valve bodies and bonnets exposed to	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for ASME~~	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB,	~~IV.C2.RP-231~~ No	IV.C1.R-08 IV.C2-~~22(~~.R-~~14)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~tank (tank shell and heads, flanges, nozzles) exposed to treated borated water >60°C (>140°F)~~BWR/PWR	reactor coolant >250 °C (>482 °F)	~~components, and Chapter XI.M2, "Water Chemistry"~~ Loss of fracture toughness due to thermal aging embrittlement	IWC, and IWD." For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary. The ASME Section XI inspection requirements are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS valve bodies.		08
~~35~~M	~~PWR~~39	~~Stainless steel, steel with stainless steel cladding reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor~~	~~Cracking due to cyclic loading~~Steel (with or without stainless steel or nickel alloy cladding), stainless steel, or nickel alloy Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components~~Cracking due to stress corrosion cracking (for stainless steel or nickel alloy surfaces exposed to reactor coolant only),	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," AMP XI.M2, "Water Chemistry," and XI.M35, "One-Time Inspection	~~IV.C2.R-56~~ No	IV.C1.RP-230 IV.C2~~-26(R-56)~~.RP-235

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~coolant~~BWR/PWR		intergranular stress corrosion cracking (for stainless steel or nickel alloy surfaces exposed to reactor coolant only), or thermal, mechanical, or vibratory loading	of ASME Code Class 1 Small-Bore Piping"		
~~36~~M	~~PWR~~40	~~Steel, stainless steel pressurizer integral support exposed to air with metal temperature up to 288°C (550°F)~~PWR	~~Cracking due to cyclic loading~~Steel with stainless steel or nickel alloy cladding; or stainless steel pressurizer components exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components~~Cracking due to cyclic loading	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	~~IV.C2.R-19~~ No	IV.C2~~-16(~~.R-~~19)~~ 58
~~37~~M	~~PWR~~40a	~~Steel reactor vessel flange~~PWR	~~Loss of material due to wear~~Nickel alloy core support pads; core guide lugs exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components~~Cracking due to primary water stress corrosion cracking	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.A2.R-87~~ No	IV.A2~~-25(R-87)~~ .RP-57
~~38~~M	~~BWR/PWR~~ 41	~~Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant~~	~~Loss of fracture toughness due to thermal aging embrittlement~~Nickel alloy core shroud and core plate access hole cover (mechanical covers)	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components. For pump casings and valve~~	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2,	~~IV.C1.R-08~~ ~~IV.C2.R-08~~ Yes (SRP-SLR Section 3.1.2.2.12.2)	IV.~~C1-3(~~B1.R-~~08)~~ ~~IV.C2-6(R-08)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~>250 deg-C (>482 deg-F)~~BWR	exposed to reactor coolant	~~bodies, screening for susceptibility to thermal aging is not necessary.~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	"Water Chemistry"		95
~~39~~M	~~BWR/PWR~~ 42	~~Steel, stainless steel, or steel with stainless steel cladding Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal, mechanical, and vibratory loading~~Steel with stainless steel or nickel alloy cladding; stainless steel primary side components; steam generator upper and lower heads, and tube sheet welds; pressurizer components exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components,~~ ~~Chapter XI.M2, "Water Chemistry," and~~ ~~XI.M35, "One-Time Inspection of ASME Code Class 1 Small-bore Piping"~~Cracking due to stress corrosion cracking, primary water stress corrosion cracking	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.C1.RP-230~~ ~~IV.C2.RP-235~~ No	~~IV.C1-1(R-03)~~ IV.C2-~~1(~~.R-~~02)~~ 25 IV.D2.RP-47

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~40~~M	~~PWR~~43	~~Steel with stainless steel or nickel alloy cladding; or stainless steel pressurizer components exposed to reactor coolant~~BWR	~~Cracking due to cyclic loading~~Stainless steel and nickel alloy reactor vessel internals exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.C2.R-58~~ No	IV.~~C2-18(R-58)~~ B1.RP-26
M	~~PWR~~44	~~Nickel alloy core support pads; core guide lugs exposed to reactor coolant~~PWR	~~Cracking due to primary water stress corrosion cracking~~Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"~~Loss of material due to erosion	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	~~IV.A2.RP-57~~No	IV.~~A2-12(~~D2.R-~~88)~~31
~~41~~	~~BWR~~45	~~Nickel alloy core shroud and core plate access hole cover (mechanical covers) exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking~~Nickel alloy and steel with nickel-alloy cladding reactor coolant pressure boundary	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"~~ Cracking due to primary water	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD," and AMP XI.M2, "Water Chemistry," and, for nickel-alloy,	~~IV.B1.R-95~~ No	~~IV.B1-4(R-95)~~ IV.A2.R-90 IV.A2.RP-186 IV.A2.RP-59 IV.C2.RP

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			components exposed to reactor coolant	stress corrosion cracking	AMP XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in RCPB Components (PWRs Only)"		-156 IV.C2.RP-159 IV.C2.RP-37 IV.D1.RP-36 IV.D2.RP-36
~~42~~	~~PWR~~46	~~Steel with stainless steel or nickel alloy cladding or stainless steel primary side components; steam generator upper and lower heads, and tube sheet weld; or pressurizer components exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking, primary water stress corrosion cracking~~Stainless steel, nickel alloy, nickel alloy welds and/or buttering control rod drive head penetration pressure housing or nozzle safe ends and welds (inlet, outlet, safety injection) exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"~~ Cracking due to stress corrosion cracking, primary water stress corrosion cracking	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD," and AMP XI.M2, "Water Chemistry," and, for nickel-alloy, AMP XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced corrosion in RCPB	~~IV.C2.R-25~~ ~~IV.D2.RP-47~~ No	IV.~~C2-19(R-25)~~ ~~IV.D2-4(R-35)~~ A2.RP-234

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
					Components (PWRs Only)"		
~~43~~	~~BWR~~47	~~Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant~~PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel, nickel alloy control rod drive head penetration pressure housing exposed to reactor coolant	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"~~ Cracking due to stress corrosion cracking, primary water stress corrosion cracking	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD," and AMP XI.M2, "Water Chemistry"	~~IV.B1.RP-26~~ No	IV.~~B1-15(~~A2.RP-~~26)~~ 55
~~44~~	~~PWR~~48	~~Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam~~PWR	~~Loss of material due to erosion~~Steel external surfaces: reactor vessel top head, reactor vessel bottom head, reactor coolant pressure boundary piping or components adjacent to dissimilar metal (Alloy 82/182) welds exposed to air with borated water leakage	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 2 components~~Loss of material due to boric acid corrosion	~~No~~AMP XI.M10, "Boric Acid Corrosion," and AMP XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid- Induced Corrosion in RCPB Components (PWRs Only)"	~~IV.D2.R-31~~ No	IV.~~D2-5(R-31)~~ A2.RP-379 IV.C2.RP-380

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~45~~M	~~PWR~~49	~~Nickel alloy and steel with nickel-alloy cladding reactor coolant pressure boundary components exposed to reactor coolant~~PWR	~~Cracking due to primary water stress corrosion cracking~~Steel reactor vessel, piping, piping components in the reactor coolant pressure boundary of PWRs, or steel steam generators in PWRs: external surfaces or closure bolting exposed to air with borated water leakage	~~Chapter XI.M1, "ASME Section XI ISI, IWB, IWC & IWD," and Chapter XI.M2, "Water Chemistry," and, for nickel-alloy, Chapter XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in RCPB Components (PWRs Only)~~"Loss of material due to boric acid corrosion	~~No~~AMP XI.M10, "Boric Acid Corrosion"	~~IV.A2.R-90~~ ~~IV.A2.RP-186~~ ~~IV.A2.RP-59~~ ~~IV.C2.RP-156~~ ~~IV.C2.RP-159~~ ~~IV.C2.RP-37~~ ~~IV.D1.RP-36~~ ~~IV.D2.RP-36~~ No	IV.A2~~-18(~~.R-~~90)~~ ~~IV.A2-9(R-75)~~ ~~IV.A2-19(R-89)~~ 17 IV.C2~~-24(RP-22)~~ .R-17 IV.C2~~-13(~~.RP-~~31)~~ ~~IV.C2-21(R-06)~~ 167 IV.D1~~-4(~~.R-~~01)~~ 17 IV.D2~~-2(~~.R-~~01)~~ 17

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~46~~M	~~PWR~~50	~~Stainless steel, nickel-alloy, nickel-alloy welds and/or buttering control rod drive head penetration pressure housing or nozzles safe ends and welds (inlet, outlet, safety injection) exposed to reactor coolant~~BWR/PWR	~~Cracking due to stress corrosion cracking, primary water stress corrosion cracking~~Cast austenitic stainless steel Class 1 piping, piping component (including pump casings and control rod drive pressure housings) exposed to reactor coolant >250 °F (>482 °C)	~~Chapter XI.M1, "ASME Section XI ISI, IWB, IWC & IWD," and Chapter XI.M2, "Water Chemistry," and, for nickel-alloy, Chapter XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced corrosion in RCPB Components (PWRs Only)"~~Loss of fracture toughness due to thermal aging embrittlement	~~No~~AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	~~IV.A2.RP-234~~ No	IV.A2~~-15(~~.R-~~83)~~ 77 IV.C1.R-52 IV.C2.R-52
~~47~~D	~~PWR~~51a	~~Stainless steel, nickel-alloy control rod drive head penetration pressure housing exposed to reactor coolant~~	~~Cracking due to stress corrosion cracking, primary water stress corrosion cracking~~	~~Chapter XI.M1, "ASME Section XI ISI, IWB, IWC & IWD," and Chapter XI.M2, "Water Chemistry"~~	~~No~~	~~IV.A2.RP-55~~	~~IV.A2-11(R-76)~~
~~48~~D	~~PWR~~51b	~~Steel external surfaces: reactor vessel top head, reactor vessel bottom head, reactor coolant pressure boundary piping~~	~~Loss of material due to boric acid corrosion~~	~~Chapter XI.M10, "Boric Acid Corrosion," and~~ ~~Chapter XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced~~	~~No~~	~~IV.A2.RP-379~~ ~~IV.C2.RP-380~~	~~IV.A2-13(R-17)~~ ~~IV.C2-9(R-17)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~or components adjacent to dissimilar metal (Alloy 82/182) welds exposed to air with borated water leakage~~		~~Corrosion in RCPB Components (PWRs Only)"~~			
~~49~~D	~~PWR~~52a	~~Steel reactor coolant pressure boundary external surfaces or closure bolting exposed to air with borated water leakage~~	~~Loss of material due to boric acid corrosion~~	~~Chapter XI.M10, "Boric Acid Corrosion"~~	~~No~~	~~IV.A2.R-17~~ ~~IV.C2.R-17~~ ~~IV.C2.RP-167~~ ~~IV.D1.R-17~~ ~~IV.D2.R-17~~	~~IV.A2-13(R-17)~~ ~~IV.C2-9(R-17)~~ ~~N/A~~ ~~IV.D1-3(R-17)~~ ~~IV.D2-1(R-17)~~
~~50~~D	~~BWR/PWR~~ 52b	~~Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to~~	~~Loss of fracture toughness due to thermal aging embrittlement~~	~~Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"~~	~~No~~	~~IV.A2.R-77~~ ~~IV.C1.R-52~~ ~~IV.C2.R-52~~	~~IV.A2-10(R-77)~~ ~~IV.C1-2(R-52)~~ ~~IV.C2-4(R-52)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~reactor coolant >250 deg-C (>482 deg-F)~~					
~~51~~D	~~PWR~~52c	~~Stainless steel or nickel-alloy Babcock & Wilcox reactor internal components exposed to reactor coolant and neutron flux~~	~~Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue~~	~~Chapter XI.M16A, "PWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"~~	~~No~~	~~IV.B4.RP-236~~ ~~IV.B4.RP-241~~ ~~IV.B4.RP-244~~ ~~IV.B4.RP-245~~ ~~IV.B4.RP-246~~ ~~IV.B4.RP-247~~ ~~IV.B4.RP-248~~ ~~IV.B4.RP-254~~ ~~IV.B4.RP-256~~ ~~IV.B4.RP-261~~ ~~IV.B4.RP-262~~ ~~IV.B4.RP-352~~ ~~IV.B4.RP-375~~	~~N/A~~ ~~IV.B4-7(R-125)~~ ~~IV.B4-7(R-125)~~ ~~IV.B4-13(R-194)~~ ~~IV.B4-12(R-196)~~ ~~IV.B4-13(R-194)~~ ~~IV.B4-12(R-196)~~ ~~IV.B4-25(R-210)~~ ~~IV.B4-25(R-210)~~ ~~IV.B4-32(R-203)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~IV.B4-32(R-203)~~ ~~N/A~~ ~~N/A~~
~~52~~D	~~PWR~~53a	~~Stainless steel or nickel-alloy Combustion Engineering reactor internal components exposed to reactor coolant and neutron flux~~	~~Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue~~	~~Chapter XI.M16A, "PWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"~~	~~No~~	~~IV.B3.RP-306~~ ~~IV.B3.RP-312~~ ~~IV.B3.RP-313~~ ~~IV.B3.RP-314~~ ~~IV.B3.RP-316~~ ~~IV.B3.RP-320~~ ~~IV.B3.RP-322~~ ~~IV.B3.RP-323~~ ~~IV.B3.RP-324~~ ~~IV.B3.RP-325~~ ~~IV.B3.RP-327~~ ~~IV.B3.RP-328~~	~~N/A~~ ~~IV.B3-2(R-149)~~ ~~N/A~~ ~~IV.B3-9(R-162)~~ ~~IV.B3-9(R-162)~~ ~~IV.B3-9(R-162)~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~IV.B3.RP-329~~ ~~IV.B3.RP-330~~ ~~IV.B3.RP-334~~ ~~IV.B3.RP-335~~ ~~IV.B3.RP-342~~ ~~IV.B3.RP-358~~	~~IV.B3-15(R-155)~~ ~~IV.B3-15(R-155)~~ ~~IV.B3-15(R-155)~~ ~~IV.B3-23(R-167)~~ ~~IV.B3-23(R-167)~~ ~~IV.B3-23(R-167)~~ ~~N/A~~ ~~N/A~~
~~53~~D	~~PWR~~53b	~~Stainless steel or nickel-alloy Westinghouse reactor internal components exposed to reactor coolant and neutron flux~~	~~Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue~~	~~Chapter XI.M16A, "PWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"~~	~~No~~	~~IV.B2.RP-265~~ ~~IV.B2.RP-271~~ ~~IV.B2.RP-273~~ ~~IV.B2.RP-275~~ ~~IV.B2.RP-276~~	~~N/A~~ ~~IV.B2-10(R-125)~~ ~~IV.B2-10(R-125)~~ ~~IV.B2-6(R-128)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~IV.B2.RP-278~~ ~~IV.B2.RP-280~~ ~~IV.B2.RP-282~~ ~~IV.B2.RP-286~~ ~~IV.B2.RP-289~~ ~~IV.B2.RP-291~~ ~~IV.B2.RP-293~~ ~~IV.B2.RP-294~~ ~~IV.B2.RP-298~~ ~~IV.B2.RP-301~~ ~~IV.B2.RP-346~~ ~~IV.B2.RP-387~~	~~IV.B2-8(R-120)~~ ~~IV.B2-8(R-120)~~ ~~IV.B2-8(R-120)~~ ~~IV.B2-8(R-120)~~ ~~IV.B2-16(R-133)~~ ~~IV.B2-20(R-130)~~ ~~IV.B2-24(R-138)~~ ~~IV.B2-24(R-138)~~ ~~IV.B2-24(R-138)~~ ~~IV.B2-28(R-118)~~ ~~IV.B2-40(R-112)~~ ~~N/A~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	**~~Type~~ID**	**~~Component~~Type**	**~~Aging Effect/Mechanism~~Component**	**Aging ~~Management Programs~~Effect/Mechanism**	**~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA**	**~~Rev2 Item~~Further Evaluation Recommended**	**~~Rev1~~GALL-SLR Item**
							~~N/A~~
~~54~~D	~~PWR~~53c	~~Stainless steel bottom mounted instrument system flux thimble tubes (with or without chrome plating) exposed to reactor coolant and neutron flux~~	~~Loss of material due to wear~~	~~Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M37, "Flux Thimble Tube Inspection"~~	~~No~~	~~IV.B2.RP-284~~	~~IV.B2-12(R-143)~~ ~~IV.B2-13(R-145)~~
~~55~~M	~~PWR~~54	~~Stainless steel thermal shield assembly, thermal shield flexures exposed to reactor coolant and neutron flux~~PWR	~~Cracking due to fatigue; Loss of material due to wear~~Stainless steel bottom mounted instrument system flux thimble tubes (with or without chrome plating) exposed to reactor coolant and neutron flux	~~Chapter XI.M16A, “PWR Vessel Internals”~~Loss of material due to wear	~~No~~AMP XI.M37, "Flux Thimble Tube Inspection"	~~IV.B2.RP-302~~ No	~~N/A~~ IV.B2.RP-284
~~56~~D	~~PWR~~55a	~~Stainless steel or nickel-alloy Combustion Engineering reactor internal components exposed to~~	~~Loss of fracture toughness due to neutron irradiation embrittlement; or changes in dimension due to void swelling; or loss of preload due to thermal and irradiation~~	~~Chapter XI.M16A, “PWR Vessel Internals”~~	~~No~~	~~IV.B3.RP-307~~ ~~IV.B3.RP-315~~ ~~IV.B3.RP-317~~ ~~IV.B3.RP-318~~	~~N/A~~ ~~IV.B3-7(R-165)~~ ~~IV.B3-7(R-165)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~reactor coolant and neutron flux~~	~~enhanced stress relaxation; or loss of material due to wear~~			~~IV.B3.RP-319~~ ~~IV.B3.RP-326~~ ~~IV.B3.RP-331~~ ~~IV.B3.RP-332~~ ~~IV.B3.RP-336~~ ~~IV.B3.RP-359~~ ~~IV.B3.RP-360~~ ~~IV.B3.RP-361~~ ~~IV.B3.RP-362~~ ~~IV.B3.RP-363~~ ~~IV.B3.RP-364~~ ~~IV.B3.RP-365~~ ~~IV.B3.RP-366~~	~~IV.B4-8(R-163)~~ ~~IV.B3-9(R-162)~~ ~~N/A~~ ~~N/A~~ ~~IV.B3-17(R-156)~~ ~~IV.B3-22(R-170)~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
D	55b						
~~58~~D	~~PWR~~55c	~~Stainless steel or nickel-alloy Babcock & Wilcox reactor internal components exposed to reactor coolant and neutron flux~~	~~Loss of fracture toughness due to neutron irradiation embrittlement; or changes in dimension due to void swelling; or loss of preload due to thermal and irradiation enhanced stress relaxation; or loss of material due to wear~~	~~Chapter XI.M16A, "PWR Vessel Internals"~~	~~No~~	~~IV.B4.RP-237~~ ~~IV.B4.RP-240~~ ~~IV.B4.RP-242~~ ~~IV.B4.RP-243~~ ~~IV.B4.RP-249~~ ~~IV.B4.RP-250~~ ~~IV.B4.RP-251~~ ~~IV.B4.RP-252~~ ~~IV.B4.RP-253~~ ~~IV.B4.RP-258~~ ~~IV.B4.RP-259~~ ~~IV.B4.RP-260~~	~~N/A~~ ~~IV.B4-1(R-128)~~ ~~IV.B4-4(R-183)~~ ~~IV.B4-1(R-128)~~ ~~IV.B4-12(R-196)~~ ~~IV.B4-12(R-196)~~ ~~IV.B4-15(R-190)~~ ~~IV.B4-16(R-188)~~ ~~IV.B4-21(R-191)~~ ~~IV.B4-4(R-183)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~IV.B4-31(R-205)~~ ~~IV.B4-31(R-205)~~
~~59~~D	~~PWR~~56a	~~Stainless steel or nickel-alloy Westinghouse reactor internal components exposed to reactor coolant and neutron flux~~	~~Loss of fracture toughness due to neutron irradiation embrittlement; or changes in dimension due to void swelling; or loss of preload due to thermal and irradiation enhanced stress relaxation; or loss of material due to wear~~	~~Chapter XI.M16A, "PWR Vessel Internals"~~	~~No~~	~~IV.B2.RP-267~~ ~~IV.B2.RP-270~~ ~~IV.B2.RP-272~~ ~~IV.B2.RP-274~~ ~~IV.B2.RP-281~~ ~~IV.B2.RP-285~~ ~~IV.B2.RP-287~~ ~~IV.B2.RP-288~~ ~~IV.B2.RP-290~~ ~~IV.B2.RP-292~~ ~~IV.B2.RP-295~~ ~~IV.B2.RP-296~~ ~~IV.B2.RP-297~~	~~N/A~~ ~~IV.B2-1(R-124)~~ ~~IV.B2-6(R-128)~~ ~~IV.B2-6(R-128)~~ ~~IV.B2-9(R-122)~~ ~~IV.B2-14(R-137)~~ ~~IV.B2-17(R-135)~~ ~~IV.B2-18(R-132)~~ ~~IV.B2-21(R-140)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~IV.B2.RP-299~~ ~~IV.B2.RP-300~~ ~~IV.B2.RP-345~~ ~~IV.B2.RP-354~~ ~~IV.B2.RP-386~~ ~~IV.B2.RP-388~~	~~IV.B2-21(R-140)~~ ~~IV.B2-22(R-141)~~ ~~N/A~~ ~~N/A~~ ~~IV.B2-34(R-115)~~ ~~IV.B2-33(R-108)~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~
~~60~~D	~~BWR~~56b	~~Steel piping, piping components, and piping elements exposed to reactor coolant~~	~~Wall thinning due to flow-accelerated corrosion~~	~~Chapter XI.M17, “Flow-Accelerated Corrosion”~~	~~No~~	~~IV.C1.R-23~~	~~IV.C1-7(R-23)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~61~~D	~~PWR~~56c	~~Steel steam generator steam nozzle and safe end, feedwater nozzle and safe end, AFW nozzles and safe ends exposed to secondary feedwater/steam~~	~~Wall thinning due to flow-accelerated corrosion~~	~~Chapter XI.M17, "Flow-Accelerated Corrosion"~~	~~No~~	~~IV.D1.R-37~~ ~~IV.D2.R-38~~	~~IV.D1-5(R-37)~~ ~~IV.D2-7(R-38)~~
~~62~~D	~~PWR~~58a	~~High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage~~	~~Cracking due to stress corrosion cracking~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~IV.A2.R-78~~ ~~IV.C2.R-11~~ ~~IV.D1.R-10~~	~~IV.A2-6(R-78)~~ ~~IV.C2-7(R-11)~~ ~~IV.D1-2(R-10)~~
~~63~~D	~~BWR~~58b	~~Steel or stainless steel closure bolting exposed to air with reactor coolant leakage~~	~~Loss of material due to general (steel only), pitting, and crevice corrosion or wear~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~IV.C1.RP-42~~	~~IV.C1-12(R-26)~~
~~64~~D	~~PWR~~59a	~~Steel closure bolting exposed to air – indoor uncontrolled~~	~~Loss of material due to general, pitting, and crevice corrosion~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~IV.C2.RP-166~~	~~N/A~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~65~~D	~~PWR~~59b	~~Stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage~~	~~Loss of material due to wear~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~IV.A2.R-79~~	~~IV.A2-7(R-79)~~
~~66~~D	~~PWR~~59c	~~High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage~~	~~Loss of preload due to thermal effects, gasket creep, and self-loosening~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~IV.A2.R-80~~ ~~IV.C2.R-12~~	~~IV.A2-8(R-80)~~ ~~IV.C2-8(R-12)~~
~~67~~M	~~BWR/PWR~~ 60	~~Steel or stainless steel closure bolting exposed to air – indoor with potential for reactor coolant leakage~~BWR	~~Loss of preload due to thermal effects, gasket creep, and self-loosening~~Steel piping, piping components exposed to reactor coolant	~~Chapter XI.M18, "Bolting Integrity"~~Wall thinning due to flow-accelerated corrosion	~~No~~AMP XI.M17, "Flow-Accelerated Corrosion"	~~IV.C1.RP-43~~ ~~IV.D1.RP-46~~ ~~IV.D2.RP-46~~ No	IV.C1-~~10(~~.R-~~27)~~ ~~IV.D1-10(R-32)~~ ~~IV.D2-6(R-32)~~ 23
~~68~~	~~PWR~~61	~~Nickel alloy steam generator tubes exposed to~~	~~Changes in dimension ("denting") due to corrosion of carbon steel~~	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2,~~	~~No~~AMP XI.M17, "Flow-	~~IV.D1.R-43~~ ~~IV.D2.R-226~~	IV.D1-~~19(~~.R-~~43)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~secondary feedwater or steam~~PWR	~~tube support plate~~Steel steam generator steam nozzle and safe end, feedwater nozzle and safe end, AFW nozzles and safe ends exposed to secondary feedwater/steam	~~"Water Chemistry"~~Wall thinning due to flow-accelerated corrosion	Accelerated Corrosion"	No	37 IV.D2~~-13(~~.R-~~226)~~ 38
~~69~~	~~PWR~~62	~~Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam~~PWR	~~Cracking due to outer diameter stress corrosion cracking and intergranular attack~~High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M18, "Bolting Integrity"	~~IV.D1.R-47~~ ~~IV.D1.R-48~~ ~~IV.D2.R-47~~ ~~IV.D2.R-48~~ No	IV.~~D1-23(~~A2.R-~~47)~~ 78 IV.~~D1-22(~~C2.R-~~48)~~ 11 IV.~~D2-17(~~D1.R-~~47)~~ ~~IV.D2-16(R-48)~~ 10
~~70~~	~~PWR~~63	~~Nickel alloy steam generator tubes, repair sleeves, and tube plugs~~	~~Cracking due to primary water stress corrosion cracking~~Steel or stainless steel closure bolting exposed to air	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"~~Loss of material due to	~~No~~AMP XI.M18, "Bolting Integrity"	~~IV.D1.R-40~~ ~~IV.D1.R-44~~ ~~IV.D2.R-40~~	IV.~~D1-18(R-40)~~ ~~IV.D1-20(R-44)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~exposed to reactor coolant~~BWR	with reactor coolant leakage	general (steel only), pitting, crevice corrosion, wear		~~IV.D2.R-44~~ No	~~IV.D2-12(R-40)~~ ~~IV.D2-14(R-44)~~ C1.RP-42
~~71~~	~~PWR~~64	~~Steel, chrome plated steel, stainless steel, nickel alloy steam generator U-bend supports including anti-vibration bars exposed to secondary feedwater or steam~~PWR	~~Cracking due to stress corrosion cracking or other mechanism(s); loss of material due general (steel only), pitting, and crevice corrosion~~Steel closure bolting exposed to air – indoor uncontrolled	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M18, "Bolting Integrity"	~~IV.D1.RP-226~~ ~~IV.D1.RP-384~~ No	IV.~~D1-15(~~C2.RP-~~15)~~ ~~IV.D1-14(RP-14)~~ 166
~~72~~	~~PWR~~65	~~Steel steam generator tube support plate, tube bundle wrapper, supports and mounting hardware exposed to secondary~~	~~Loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion~~Stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"~~Loss of material due to wear	~~No~~AMP XI.M18, "Bolting Integrity"	~~IV.D1.R-42~~ ~~IV.D1.RP-161~~ ~~IV.D2.R-42~~ ~~IV.D2.RP-162~~ No	IV.~~D1-17(~~A2.R-~~42)~~ ~~IV.D1-9(RP-16)~~ ~~IV.D2-11(R-42)~~ ~~N/A~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~feedwater or steam~~PWR					79
~~73~~	~~PWR~~66	~~Nickel alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater or steam~~PWR	~~Loss of material due to wastage and pitting corrosion~~High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"~~Loss of preload due to thermal effects, gasket creep, or self-loosening	~~No~~AMP XI.M18, "Bolting Integrity"	~~IV.D1.R-50~~ No	IV.~~D1-25(~~A2.R-~~50)~~ 80 IV.C2.R-12
~~74~~	~~PWR~~67	~~Steel steam generator upper assembly and separators including feedwater inlet ring and support exposed to secondary feedwater or steam~~BWR/PWR	~~Wall thinning due to flow-accelerated corrosion~~Steel or stainless steel closure bolting exposed to air – indoor with potential for reactor coolant leakage	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"~~Loss of preload due to thermal effects, gasket creep, or self-loosening	~~No~~AMP XI.M18, "Bolting Integrity"	~~IV.D1.RP-49~~ No	IV.C1.RP-43 IV.D1-~~26(R-51)~~ .RP-46 IV.D2.RP-46
~~75~~	~~PWR~~68	~~Steel steam generator tube support lattice bars exposed to secondary~~	~~Wall thinning due to flow-accelerated corrosion and general corrosion~~Nickel alloy steam generator tubes	~~Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"~~Changes in	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2,	~~IV.D1.RP-48~~ No	IV.D1-~~16(~~.R-~~41)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~feedwater or steam~~PWR	exposed to secondary feedwater or steam	dimension ("denting") due to corrosion of carbon steel tube support plate	"Water Chemistry"		43 IV.D2.R-226
~~76~~	~~PWR~~69	~~Steel, chrome plated steel, stainless steel, nickel alloy steam generator U-bend supports including anti-vibration bars exposed to secondary feedwater or steam~~PWR	~~Loss of material due to fretting~~Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam	~~Chapter XI.M19, "Steam Generators"~~Cracking due to outer diameter stress corrosion cracking or intergranular attack	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2, "Water Chemistry"	~~IV.D1.RP-225~~ No	~~IV.D1-15(RP-15)~~ IV.D1.R-47 IV.D1.R-48 IV.D2.R-47 IV.D2.R-48
~~77~~	~~PWR~~70	~~Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam~~PWR	~~Loss of material due to wear and fretting~~Nickel alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant	~~Chapter XI.M19, "Steam Generators"~~Cracking due to primary water stress corrosion cracking	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2, "Water Chemistry"	~~IV.D1.RP-233~~ ~~IV.D2.RP-233~~ No	IV.D1~~-24(~~.R-~~49)~~ 40 IV.D1.R-44 IV.D2~~-18(~~.R-~~49)~~ 40 IV.D2.R-44

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~78~~	~~PWR~~71	~~Nickel alloy steam generator components such as, secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater or steam~~PWR	~~Cracking due to stress corrosion cracking~~Steel, chrome plated steel, stainless steel, nickel alloy steam generator U-bend supports including anti- vibration bars exposed to secondary feedwater or steam	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection," or Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."~~ Cracking due to stress corrosion cracking or other mechanism(s); loss of material due general (steel only), pitting, crevice corrosion	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2, "Water Chemistry"	~~IV.D2.R-36~~ No	IV.~~D2-9(R-36)~~ D1.RP-226 IV.D1.RP-384
~~79~~	~~BWR~~72	~~Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant~~PWR	~~Loss of material due to pitting and crevice corrosion~~Steel steam generator tube support plate, tube bundle wrapper, supports and mounting hardware exposed to secondary feedwater or steam	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to erosion, general, pitting, crevice corrosion, ligament cracking due to corrosion	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2, "Water Chemistry"	~~IV.C1.RP-158~~ No	~~IV.C1-14(RP-27)~~ IV.D1.R-42 IV.D1.RP-161 IV.D2.R-42 IV.D2.RP-162
~~80~~	~~PWR~~73	~~Stainless steel or steel with stainless steel cladding~~	~~Cracking due to stress corrosion cracking~~Nickel alloy steam generator tubes and sleeves	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2,	~~IV.C2.RP-383~~ No	~~N/A~~ IV.D1.R-50

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~pressurizer relief tank: tank shell and heads, flanges, nozzles (none-ASME Section XI components) exposed to treated borated water >60°C (>140°F)~~PWR	exposed to phosphate chemistry in secondary feedwater or steam	of material due to wastage, pitting corrosion	"Water Chemistry"		
~~81~~	~~PWR~~74	~~Stainless steel pressurizer spray head exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking~~Steel steam generator upper assembly and separators including feedwater inlet ring and support exposed to secondary feedwater or steam	~~Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”~~Wall thinning due to flow-accelerated corrosion	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2, "Water Chemistry"	~~IV.C2.RP-41~~ No	IV.~~C2-17(R-24)~~ D1.RP-49
~~82~~	~~PWR~~75	~~Nickel alloy pressurizer spray head exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking, primary water stress corrosion cracking~~Steel steam generator tube support lattice bars exposed to secondary feedwater or steam	~~Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”~~Wall thinning due to flow-accelerated corrosion, general corrosion	~~No~~AMP XI.M19, "Steam Generators," and AMP XI.M2, "Water Chemistry"	~~IV.C2.RP-40~~ No	IV.~~C2-17(R-24)~~ D1.RP-48
~~83~~M	~~PWR~~76	~~Steel steam generator shell assembly exposed to~~	~~Loss of material due to general, pitting, and crevice corrosion~~Steel, chrome plated steel,	~~Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”~~Loss	~~No~~AMP XI.M19, "Steam Generators"	~~IV.D1.RP-372~~ ~~IV.D2.RP-153~~	~~N/A~~

**Table 3.1-1.	Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report**

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~secondary feedwater or steam~~PWR	stainless steel, nickel alloy steam generator U-bend supports including anti- vibration bars exposed to secondary feedwater or steam	of material due to wear, fretting		No	IV.~~D2-8(R-224)~~ D1.RP-225
~~84~~	~~BWR~~77	~~Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant~~PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam	~~Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”~~Loss of material due to wear, fretting	~~No~~AMP XI.M19, "Steam Generators"	~~IV.A1.RP-50~~ No	IV.~~A1-11(R-59)~~ D1.RP-233 IV.D2.RP-233
~~85~~	~~BWR~~78	~~Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds exposed to reactor coolant~~PWR	~~Loss of material due to pitting and crevice corrosion~~Nickel alloy steam generator components such as, secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater or steam	~~Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection," or AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."	~~IV.A1.RP-157~~ No	IV.~~A1-8(RP-25)~~ D2.R-36

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~86~~	~~PWR~~79	~~Stainless steel steam generator primary side divider plate exposed to reactor coolant~~BWR	~~Cracking due to stress corrosion cracking~~Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant	~~Chapter XI.M2, "Water Chemistry"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~IV.D1.RP-17~~ No	IV.~~D1-7(~~C1.RP-~~17)~~ 158
~~87~~	~~PWR~~80	~~Stainless steel or nickel-alloy PWR reactor internal components exposed to reactor coolant and neutron flux~~PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel or steel with stainless steel cladding pressurizer relief tank: tank shell and heads, flanges, nozzles (none-ASME Section XI components) exposed to treated borated water >60°C (>140°F)	~~Chapter XI.M2, "Water Chemistry"~~ Cracking due to stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~IV.B2.RP-24~~ ~~IV.B3.RP-24~~ ~~IV.B4.RP-24~~ No	IV.~~B2-32(~~C2.RP-~~24)~~ ~~IV.B3-25(RP-24)~~ ~~IV.B4-38(RP-24)~~ 383
~~88~~	~~PWR~~81	~~Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components~~	~~Loss of material due to pitting and crevice corrosion~~Stainless steel pressurizer spray head exposed to reactor coolant	~~Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~IV.A2.RP-28~~ ~~IV.C2.RP-23~~ No	~~IV.A2-14(RP-28)~~ IV.C2~~-15(~~.RP-~~23)~~ 41

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~exposed to reactor coolant~~PWR					
~~89~~	~~PWR~~82	~~Steel piping, piping components, and piping elements exposed to closed cycle cooling water~~PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Nickel alloy pressurizer spray head exposed to reactor coolant	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Cracking due to stress corrosion cracking, primary water stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~IV.C2.RP-221~~ No	IV.C2~~-14(~~.RP-~~10)~~ 40
~~90~~	~~PWR~~83	~~Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water~~PWR	~~Loss of material due to pitting, crevice, and galvanic corrosion~~Steel steam generator shell assembly exposed to secondary feedwater or steam	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~IV.C2.RP-222~~ No	IV.~~C2-11(~~D1.RP-~~11)~~ 372 IV.D2.RP-153
~~91~~	~~BWR~~84	~~High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage~~BWR	~~Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (BWR)~~Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and	~~Chapter XI.M3, "Reactor Head Closure Stud Bolting"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~IV.A1.RP-165~~ ~~IV.A1.RP-51~~ No	~~N/A~~ IV.A1~~-9(R-60)~~ .RP-50

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			spare) exposed to reactor coolant				
~~92~~	~~PWR~~85	~~High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage~~BWR	~~Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (PWR)~~Stainless steel, nickel alloy, and steel with nickel alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds exposed to reactor coolant	~~Chapter XI.M3, "Reactor Head Closure Stud Bolting"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~IV.A2.RP-52~~ ~~IV.A2.RP-53~~ No	IV.~~A2-2(R-71)~~ ~~IV.A2-3(R-72)~~ A1.RP-157
~~93~~	~~PWR~~86	~~Copper alloy >15% Zn or > 8% Al piping, piping components, and piping elements exposed to closed cycle cooling water~~PWR	~~Loss of material due to selective leaching~~Stainless steel steam generator primary side divider plate exposed to reactor coolant	~~Chapter XI.M33, "Selective Leaching"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry"	~~IV.C2.RP-12~~ No	IV.~~C2-12(~~D1.RP-~~12)~~ 17

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~94~~	~~BWR~~87	~~Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant~~PWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking~~Stainless steel, nickel alloy PWR reactor internal components exposed to reactor coolant, neutron flux	~~Chapter XI.M4, "BWR Vessel ID Attachment Welds," and Chapter XI.M2, "Water Chemistry"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry"	~~IV.A1.R-64~~ No	~~IV.A1-12(R-64)~~ IV.B2.RP-24 IV.B3.RP-24 IV.B4.RP-24
~~95~~	~~BWR~~88	~~Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant~~PWR	~~Cracking due to cyclic loading~~Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant	~~Chapter XI.M5, "BWR Feedwater Nozzle"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry"	~~IV.A1.R-65~~ No	IV.~~A1-3(R-65)~~ A2.RP-28 IV.C2.RP-23
~~96~~M	~~BWR~~89	~~Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant~~PWR	~~Cracking due to cyclic loading~~Steel piping, piping components exposed to closed-cycle cooling water	~~Chapter XI.M6, "BWR Control Rod Drive Return Line Nozzle"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~IV.A1.R-66~~ No	IV.~~A1-2(R-66)~~ C2.RP-221
~~97~~M	~~BWR~~90	~~Stainless steel and nickel alloy piping, piping components, and piping elements~~	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking~~Copper alloy	~~Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"~~Loss of	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~IV.A1.R-68~~ ~~IV.C1.R-20~~	IV.~~A1-1(R-68)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~greater than or equal to 4 NPS; nozzle safe ends and associated welds~~PWR	piping, piping components exposed to closed-cycle cooling water	material due to general, pitting, crevice corrosion, MIC		~~IV.C1.R-21~~ No	~~IV.C1-9(R-20)~~ ~~IV.C1-8(R-21)~~ C2.RP-222
~~98~~M	~~BWR~~91	~~Stainless steel or nickel alloy penetrations: instrumentation and standby liquid control exposed to reactor coolant~~BWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading~~Steel reactor vessel closure flange assembly components (including flanges, nut, studs, and washers) exposed to air with potential for reactor coolant leakage	~~Chapter XI.M8, "BWR Penetrations," and Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking; loss of material due to general, pitting, crevice corrosion, wear	~~No~~AMP XI.M3, "Reactor Head Closure Stud Bolting"	~~IV.A1.RP-369~~ No	IV.A1~~-5(R-69)~~ .RP-165 IV.A1.RP-51
~~99~~M	~~BWR~~92	~~Cast austenitic stainless steel; PH martensitic stainless steel; martensitic stainless steel; X-750 alloy reactor internal components exposed to reactor coolant~~	~~Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement~~Steel reactor vessel closure flange assembly components (including flanges, nut, studs, and washers) exposed to air	~~Chapter XI.M9, "BWR Vessel Internals"~~Cracking due to stress corrosion cracking; loss of material due to general, pitting, crevice corrosion, wear	~~No~~AMP XI.M3, "Reactor Head Closure Stud Bolting"	~~IV.B1.RP-182~~ ~~IV.B1.RP-200~~ ~~IV.B1.RP-219~~ ~~IV.B1.RP-220~~ No	~~N/A~~ ~~N/A~~ IV.~~B1-11(R-101)~~ A2.RP-52 IV.~~B1-9(R-103)~~ A2.RP-53

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~and neutron flux~~PWR	with potential for reactor coolant leakage				
~~100~~M	~~BWR~~93	~~Stainless steel reactor vessel internals components (jet pump wedge surface) exposed to reactor coolant~~PWR	~~Loss of material due to wear~~Copper alloy >15% Zn or > 8% Al piping, piping components exposed to closed-cycle cooling water, treated water	~~Chapter XI.M9, "BWR Vessel Internals"~~Loss of material due to selective leaching	~~No~~AMP XI.M33, "Selective Leaching"	~~IV.B1.RP-377~~ No	~~N/A~~ IV.C2.RP-12
~~101~~M	~~BWR~~94	~~Stainless steel steam dryers exposed to reactor coolant~~BWR	~~Cracking due to flow-induced vibration~~Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant	~~Chapter XI.M9, "BWR Vessel Internals" for steam dryer~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	~~No~~AMP XI.M4, "BWR Vessel ID Attachment Welds," and AMP XI.M2, "Water Chemistry"	~~IV.B1.RP-155~~ No	IV.~~B1-16(RP-18)~~ A1.R-64
~~102~~	~~BWR~~95	~~Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant~~BWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking~~Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant	~~Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"~~Cracking due to cyclic loading	~~No~~AMP XI.M5, "BWR Feedwater Nozzle"	~~IV.B1.R-104~~ No	IV.~~B1-8(~~A1.R-~~104)~~ 65
~~103~~M	~~BWR~~96	~~Stainless steel and nickel alloy reactor internal components~~	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking,~~	~~Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry"~~Cracking	~~No~~AMP XI.M1, "ASME Section XI Inservice Inspection,	~~IV.B1.R-100~~ ~~IV.B1.R-105~~	IV.~~B1-13(~~A1.R-~~100)~~

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~exposed to reactor coolant and neutron flux~~BWR	~~irradiation-assisted stress corrosion cracking~~Steel (with or without stainless steel cladding) control rod drive return line nozzles and their nozzle-to-vessel welds exposed to reactor coolant in BWR-3, BWR-4, BWR-5, and BWR-6 designs	due to cyclic loading, stress corrosion cracking, or intergranular stress corrosion cracking	Subsections IWB, IWC, and IWD"	~~IV.B1.R-92~~ ~~IV.B1.R-93~~ ~~IV.B1.R-96~~ ~~IV.B1.R-97~~ ~~IV.B1.R-98~~ ~~IV.B1.R-99~~ No	~~IV.B1-10(R-105)~~ ~~IV.B1-1(R-92)~~ ~~IV.B1-6(R-93)~~ ~~IV.B1-2(R-96)~~ ~~IV.B1-3(R-97)~~ ~~IV.B1-17(R-98)~~ ~~IV.B1-7(R-99)~~ 66
~~104~~M	~~BWR~~97	~~X-750 alloy reactor vessel internal components exposed to reactor coolant and neutron flux~~BWR	~~Cracking due to intergranular stress corrosion cracking~~Stainless steel and nickel alloy piping, piping components greater than or equal to 4 NPS; nozzle safe ends and associated welds; control rod drive return line nozzle cap and	~~Chapter XI.M9, "BWR Vessel Internals" for core plate, and~~ ~~Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	~~No~~AMP XI.M7, "BWR Stress Corrosion Cracking," and AMP XI.M2, "Water Chemistry"	~~IV.B1.RP-381~~ Yes (SRP-SLR Section 3.1.2.2.17)	~~N/A~~ IV.A1.R-412 IV.C1.R-20 IV.C1.R-21

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			associated cap-to-nozzle weld or cap-to-safe end weld in BWR-3, BWR 4, BWR 5, and BWR-6 designs				
~~105~~	~~BWR/PWR~~ 98	~~Steel piping, piping components and piping element exposed to concrete~~BWR	~~None~~Stainless steel, nickel alloy penetrations: instrumentation and standby liquid control exposed to reactor coolant	~~None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	~~No, if conditions are met.~~AMP XI.M8, "BWR Penetrations," and AMP XI.M2, "Water Chemistry"	~~IV.E.RP-353~~ No	IV.~~E-6(~~A1.RP-~~01)~~ 369
~~106~~M	~~BWR/PWR~~ 99	~~Nickel alloy piping, piping components and piping element exposed to air – indoor, uncontrolled, or air with borated~~	~~None~~Stainless steel (including cast austenitic stainless steel; PH martensitic stainless steel; martensitic stainless steel); nickel alloy (including X-750 alloy) reactor internal components exposed to	~~None~~Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement	~~NA - No AEM or AMP~~AMP XI.M9, "BWR Vessel Internals"	~~IV.E.RP-03~~ ~~IV.E.RP-378~~ Yes (SRP-SLR Section 3.1.2.2.13)	~~IV.E-1(RP-03)~~ ~~N/A~~ IV.B1.RP-182 IV.B1.RP-200

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~water leakage~~BWR	reactor coolant and neutron flux				IV.B1.RP-219 IV.B1.RP-220 IV.B1.R-416 IV.B1.R-417 IV.B1.R-419
~~107~~	~~BWR/PWR~~ 100	~~Stainless steel piping, piping components and piping element exposed to gas, concrete, air with borated water leakage, air – indoors, uncontrolled~~BWR	~~None~~Stainless steel reactor vessel internals components (jet pump wedge surface) exposed to reactor coolant	~~None~~Loss of material due to wear	~~NA - No AEM or AMP~~AMP XI.M9, "BWR Vessel Internals"	~~IV.E.RP-04~~ ~~IV.E.RP-05~~ ~~IV.E.RP-06~~ ~~IV.E.RP-07~~ No	IV.~~E-2(~~B1.RP-~~04)~~ ~~IV.E-3(RP-05)~~ ~~IV.E-4(RP-06)~~ ~~IV.E-5(RP-07)~~ 377
M	101	BWR	Stainless steel steam dryers exposed to reactor coolant	Cracking due to flow-induced vibration, stress corrosion cracking, intergranular stress corrosion cracking; loss of material due to wear	AMP XI.M9, "BWR Vessel Internals"	No	IV.B1.RP-155

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
	102	BWR	Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	AMP XI.M9, "BWR Vessel Internals," and AMP XI.M2, "Water Chemistry"	No	IV.B1.R-104
M	103	BWR	Stainless steel and nickel alloy reactor internal components exposed to reactor coolant and neutron flux	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	AMP XI.M9, "BWR Vessel Internals," and AMP XI.M2, "Water Chemistry"	Yes (SRP-SLR Section 3.1.2.2.12.1)	IV.B1.R-422 IV.B1.R-100 IV.B1.R-105 IV.B1.R-92 IV.B1.R-93 IV.B1.R-96 IV.B1.R-97 IV.B1.R-98 IV.B1.R-99
M	104	BWR	Nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux	Cracking due to intergranular stress corrosion cracking	AMP XI.M9, "BWR Vessel Internals," and AMP XI.M2, "Water Chemistry"	No	IV.B1.RP-381

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
M	105	BWR/PWR	Steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.1.2.2.18)	IV.E.RP-353
M	106	BWR/PWR	Nickel alloy piping, piping components and piping element exposed to air – indoor uncontrolled, or air with borated water leakage	None	None	No	IV.E.RP-03 IV.E.RP-378
M	107	BWR/PWR	Stainless steel piping, piping components exposed to gas, air with borated water leakage, air – indoors, uncontrolled	None	None	No	IV.E.RP-04 IV.E.RP-05 IV.E.RP-07
M	110	BWR	Any material piping, piping components exposed to reactor coolant	Wall thinning due to erosion	AMP XI.M17, "Flow-Accelerated Corrosion"	No	IV.C1.R-406
N	111	PWR	Nickel alloy steam generator tubes exposed to secondary feedwater or steam	Reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M19, "Steam Generators"	No	IV.D1.R-407 IV.D2.R-407
N	113	BWR	Steel reactor vessel external attachments exposed to indoor, uncontrolled air	Loss of material due to general, pitting, crevice corrosion, wear	AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB,	No	IV.A1.R-409

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
					IWC, and IWD," and AMP XI.M2, "Water Chemistry," for chemistry or corrosion-related aging effect mechanisms		
N	114	BWR/PWR	Reactor coolant system components defined as ASME Section XI Code Class components (ASME Code Class 1 reactor coolant pressure boundary components or core support structure components, or ASME Class 2 or 3 components - including ASME defined appurtenances, component supports, and associated pressure boundary welds, or components subject to plant-specific equivalent classifications for these ASME code classes)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (stainless steel, nickel alloy components only), cyclical loading; loss of material due to general corrosion (steel only), pitting corrosion, crevice corrosion, wear	AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	IV.E.R-444
N	115	BWR/PWR	Stainless steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.1.2.2.18)	IV.E.RP-06

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	116	PWR	Nickel alloy control rod drive penetration nozzles exposed to reactor coolant	Loss of material due to wear	Plant-specific aging management program	Yes (SRP-SLR Section 3.1.2.2.10.1)	IV.A2.R-413
N	117	PWR	Stainless steel, nickel alloy control rod drive penetration nozzle thermal sleeves exposed to reactor coolant	Loss of material due to wear	Plant-specific aging management program	Yes (SRP-SLR Section 3.1.2.2.10.2)	IV.A2.R-414
N	118	PWR	Stainless steel, nickel alloy PWR reactor vessel internal components exposed to reactor coolant, neutron flux	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, cyclical loading, fatigue	Plant-specific aging management program	Yes (SRP-SLR Section 3.1.2.2.9)	IV.B2.R-423 IV.B3.R-423 IV.B4.R-423
N	119	PWR	Stainless steel, nickel alloy PWR reactor vessel internal components exposed to reactor coolant, neutron flux	Loss of fracture toughness due to neutron irradiation embrittlement or thermal aging embrittlement; changes in dimensions due to void swelling or distortion; loss of preload due to thermal and irradiation enhanced stress relaxation or creep; loss of material due to wear	Plant-specific aging management program	Yes (SRP-SLR Section 3.1.2.2.9)	IV.B2.R-424 IV.B3.R-424 IV.B4.R-424

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	120	BWR	Stainless steel core plate rim holddown bolts exposed to reactor coolant and neutron flux	Loss of preload due to thermal or irradiation-enhanced stress relaxation	AMP XI.M9, "BWR Vessel Internals," and TLAA SRP-SLR 4.7 "Other Plant-Specific TLAAs" (if an analysis is performed as part of the aging management basis and conforms to the definition of a TLAA in 10 CFR 54.3(a))	Yes (only if a TLAA exists for the CLB) (SRP-SLR Section 3.1.2.2.14)	IV.B1.R-420
N	121	BWR	Stainless steel jet pump assembly holddown beam bolts exposed to reactor coolant and neutron flux	Loss of preload due to thermal or irradiation-enhanced stress relaxation	AMP XI.M9, "BWR Vessel Internals"	No	IV.B1.R-421
N	122	BWR/PWR	Steel, stainless steel, nickel alloy, copper alloy Non-ASME Code Class 1 piping, piping components exposed to air – indoor, condensation	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	IV.C1.R-429 IV.C2.R-429
N	124	BWR/PWR	Steel, stainless steel, nickel alloy, copper alloy piping, piping	Loss of material due to general (steel and copper alloy only),	AMP XI.M36, "External Surfaces Monitoring of	No	IV.C1.R-431 IV.C2.R-431

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			components exposed to condensation	pitting, crevice corrosion	Mechanical Components"		
N	125	PWR	Nickel alloy steam generator tubes at support plate locations exposed to secondary feedwater or steam	Cracking due to flow-induced vibration or high-cycle fatigue	AMP XI.M2, "Water Chemistry," and AMP XI.M19, "Steam Generators"	No	IV.D1.R-437 IV.D2.R-442
N	127	PWR	Steel (with stainless steel or nickel alloy cladding) steam generator heads exposed to reactor coolant	Loss of material due to boric acid corrosion	AMP XI.M2, "Water Chemistry," and plant-specific aging management program	Yes (SRP-SLR Section 3.1.2.2.15)	IV.D1.R-436 IV.D2.R-440
N	128	BWR	Stainless steel, nickel alloy nozzles safe ends and welds: high pressure core spray; low pressure core spray; recirculating water, low pressure coolant injection or RHR injection mode exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	AMP XI.M7, "BWR Stress Corrosion Cracking," and AMP XI.M2, "Water Chemistry"	No	IV.A1.R-68
N	129	BWR	Steel and stainless steel piping, piping components exposed to reactor coolant: welded	Cracking due to cyclic loading	Plant-specific aging management program	Yes (SRP-SLR Section 3.1.2.2.16.1)	IV.C1.R-432

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			connections between the re-routed control rod drive return line and the inlet piping system that delivers return line flow to the reactor pressure vessel exposed to reactor coolant				
N	130	BWR	Steel (with or without stainless steel cladding) control rod drive return line nozzles and their nozzle-to-vessel welds exposed to reactor coolant in BWR-2 designs	Cracking due to cyclic loading	Plant-specific aging management program	Yes (SRP-SLR Section 3.1.2.2.16.2)	IV.A1.R-411
N	133	BWR/PWR	Steel components exposed to reactor coolant or treated water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No	IV.A1.R-448 IV.C1.R-448 IV.C2.R-448 IV.D1.R-448 IV.D2.R-448
N	134	BWR/PWR	Jacketed thermal insulation in air-indoor uncontrolled, air with borated water leakage, air with reactor coolant	Reduced thermal insulation resistance due to moisture intrusion	AMP XI.M36, "External Surfaces Monitoring of	No	IV.A1.R-450 IV.A2.R-450 IV.C1.R-

Table 3.1-1. Summary of Aging Management Programs for Reactor Vessel, Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			leakage, or air with steam or feedwater leakage		Mechanical Components"		450 IV.C2.R-450 IV.D1.R-450 IV.D2.R-450

Table 3.1-2.	**Aging Management Programs and Additional Guidance Appendices Recommended for Reactor Vessel, Internals, and Reactor Coolant System**
GALL-SLR Report Chapter/AMP	**Program Name**
~~Chapter~~AMP X.M1	~~Metal Fatigue of Reactor Coolant Pressure Boundary~~Cyclic Load Monitoring
~~Chapter~~AMP XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
~~Chapter~~AMP XI.M2	Water Chemistry
~~Chapter~~AMP XI.M3	Reactor Head Closure Stud Bolting
~~Chapter~~AMP XI.M4	~~BWR~~Boiling Water Reactor Vessel ID Attachment Welds
~~Chapter~~AMP XI.M5	~~BWR~~Boiling Water Reactor Feedwater Nozzle
~~Chapter~~AMP XI.M6	~~BWR Control Rod Drive Return Line Nozzle~~Deleted
~~Chapter~~AMP XI.M7	~~BWR~~Boiling Water Reactor Stress Corrosion Cracking
~~Chapter~~AMP XI.M8	~~BWR~~Boiling Water Reactor Penetrations
~~Chapter~~AMP XI.M9	~~BWR~~Boiling Water Reactor Vessel Internals
~~Chapter~~AMP XI.M10	Boric Acid Corrosion
~~Chapter~~AMP XI.M11B	Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs only)
~~Chapter~~AMP XI.M12	Thermal Aging of Cast Austenitic Stainless Steel (CASS)
~~Chapter~~AMP XI.M16A	~~PWR Vessel Internals~~Deleted
~~Chapter~~AMP XI.M17	Flow-Accelerated Corrosion
~~Chapter~~AMP XI.M18	Bolting Integrity
~~Chapter~~AMP XI.M19	Steam Generators
~~Chapter~~AMP XI.M21A	Closed Treated Water Systems
~~Chapter~~AMP XI.M31	Reactor Vessel Surveillance
~~Chapter~~AMP XI.M32	One-Time Inspection
~~Chapter~~AMP XI.M33	Selective Leaching
~~Chapter~~AMP XI.M35	~~One-Time Inspection of~~ ASME Code Class 1 Small Bore-~~-~~Piping
~~Chapter~~AMP XI.M37	Flux Thimble Tube Inspection
GALL-SLR Report Appendix ~~for GALL~~A	Quality Assurance for Aging Management Programs
GALL-SLR Report Appendix B	Operating Experience for Aging Management Programs
SRP-~~LR~~SLR Appendix A.1	~~Plant-specific AMP~~Aging Management Review—Generic (Branch Technical Position RLSB-1)

3.2 Aging Management of Engineered Safety Features

Review Responsibilities

Primary~~–~~—Branch assigned responsibility by Project Manager (PM) as described in Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-~~LR~~SLR) Section 3.0 of this SRP-~~LR~~SLR Report.

3.2.1 Areas of Review

This section addresses the aging management review (AMR) and the associated aging management ~~program~~programs (AMP) of the engineered safety features. 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). The engineered safety features contained in this review plan section are generally consistent with those contained in NUREG~~-~~-0800 except for the refueling water, control room habitability, and residual heat removal systems. For older plants, the location of applicable information is plant-specific because an older plant's ~~Final Safety Analysis Report~~ ~~(~~FSAR~~)~~ may have predated NUREG~~-~~-0800.

The engineered safety features consist of containment spray, standby gas treatment [boiling ~~Water Reactors~~ water reactor (BWRs)], containment isolation components, and emergency core cooling systems.

The responsible review organization is to review the following subsequent license renewal application (~~LRA~~SLRA) AMR and AMP items assigned to it, per SRP-~~LR~~SLR Section 3.0:

AMRs

- AMR results consistent with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
- AMR results for which further evaluation is recommended ~~by the GALL Report~~
- AMR results not consistent with or not addressed in the GALL-SLR Report

AMPs

- Consistent with GALL-SLR Report AMPs
- Plant-specific AMPs

FSAR Supplement

- The responsible review organization is to review the FSAR Supplement associated with each assigned AMP.

3.2.2 Acceptance Criteria

The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the ~~NRC's~~U.S. Nuclear Regulatory Commission's (NRC) regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21.

3.2.2.1 AMR Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The AMR and the AMPs applicable to the engineered safety features are described and evaluated in Chapter V of ~~NUREG-1801 (~~the GALL-SLR Report~~)~~.

The applicant's ~~LRA~~SLRA should provide sufficient information so that the NRC reviewer is able to confirm that the specific ~~LRA~~SLRA AMR item and the associated ~~LRA~~SLRA AMP are consistent with the cited GALL-SLR Report AMR item. The reviewer should then confirm that the ~~LRA~~SLRA AMR item is consistent with the GALL-SLR Report AMR item to which it is compared.

When the applicant is crediting a different ~~aging management program~~AMP than recommended in the GALL-SLR Report, the reviewer should confirm that the alternate ~~aging management program~~AMP is valid to use for aging management and will be capable of managing the effects of aging as adequately as the ~~aging management program~~AMP recommended by the GALL-SLR Report.

3.2.2.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic acceptance criteria defined in Subsection 3.2.2.1 need to be applied first for all of the AMRs and AMPs reviewed as part of this section. In addition, if the GALL-SLR Report AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.2-1, comparing the "Further Evaluation Recommended" and the "~~Rev2~~GALL-SLR Item" ~~columns~~column, for the AMR items that reference the following subsections. ~~The 2005 AMR item counterpart is provided in the "Rev1 Item" column.~~

3.2.2.2.1 Cumulative Fatigue Damage

Fatigue 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). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-~~LR~~SLR Report.

~~1.1.1.1.6~~ 3.2.2.2.2 Loss of Material Due to ~~Cladding Breach~~

~~Loss of material due to cladding breach could occur for PWR steel pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks, and recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).~~

~~3.2.2.2.3 Loss of Material due to~~ *Pitting and Crevice Corrosion*

~~1.~~ Loss of material due to pitting and crevice corrosion could occur in ~~partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).~~

~~Loss of material due to pitting and crevice corrosion could occur for stainless steel~~SS piping, piping components, ~~piping elements,~~ and tanks exposed to outdoor air~~.~~ or any air environment when the component is insulated or where the component is in the vicinity of insulated components. The possibility of pitting and crevice corrosion also extends to indoor components ~~exposed~~located in close proximity to sources of outdoor air ~~which has recently been introduced into buildings, i.~~(e.g., components near intake vents~~.~~). Pitting and crevice corrosion is ~~only~~ known to occur in environments containing sufficient halides (~~primarily~~e.g., chlorides) and in which ~~condensation or deliquescence~~ the presence of moisture is possible.

~~Condensation or deliquescence should generally be assumed to be possible.~~ Applicable outdoor air environments (and associated local indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, ~~those~~ within 1/2 mile of a ~~highway~~road which is treated with salt in the wintertime, ~~those~~ areas in which the soil contains more than trace chlorides, ~~those~~ plants having cooling towers where the water is treated with chlorine or chlorine compounds, and ~~those~~ areas subject to chloride contamination from other agricultural or industrial sources. ~~This item is applicable for the~~

Insulated SS components exposed to indoor air environments ~~described above~~and outdoor air environments are susceptible to loss of material due to pitting or crevice corrosion if the insulation contains certain contaminants. Leakage of fluids through mechanical connections such as bolted flanges and valve packing can result in contaminants leaching onto the component surface. For outdoor insulated SS components, rain and changing weather conditions can result in moisture intrusion of the insulation.

~~GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect.~~ The applicant may demonstrate that ~~this item~~loss of material due to pitting and crevice corrosion is not expected to occur by one or more of the following applicable ~~by~~means.

- For outdoor uninsulated components, describing the outdoor air environment present at the plant and demonstrating that external pitting or crevice corrosion is not expected. ~~The GALL Report recommends further evaluation to determine whether an aging management program is needed to manage this aging effect based on the environmental conditions applicable to the plant and requirements applicable to the components.~~
- For underground components, the applicant may demonstrate that loss of material due to pitting or crevice corrosion due to exposure to in-leakage to the vault as a result of external precipitation or groundwater is not expected.
- For insulated components, determining that the insulation does not contain sufficient contaminants to cause loss of material due to pitting or crevice corrosion. One

acceptable means to demonstrate this is provided by Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel."

- For indoor components, determining that there are no liquid-filled systems with threaded or bolted connections (e.g., flanges, valve packing) that could leak onto the component.
- For all components, demonstrating that the aggressive environment is not present by isolating the component from the environment using a barrier to prevent loss of material due to pitting or crevice corrosion. An acceptable barrier includes coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating a component from a potentially aggressive environment, then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," is an acceptable method to manage the integrity of a barrier coating for internal or external coatings.

The GALL-SLR Report recommends further evaluation to determine whether an AMP is needed to manage this aging effect based on the environmental conditions applicable to the plant and requirements applicable to the components. GALL-SLR AMP XI.M36, "External Surfaces Monitoring," GALL-SLR AMP XI.M29, "Aboveground Metallic Tanks," or AMP XI.M41, "Buried and Underground Piping and Tanks," (for underground components) are acceptable methods to manage loss of material due to pitting and crevice corrosion in SS piping, piping components, and tanks.

3.2.2.2.~~4~~3 Loss of Material Due to Erosion

Loss of material due to erosion could occur in the ~~stainless steel~~SS high-pressure safety injection (HPSI) pump ~~miniflow~~minimum flow recirculation orifice exposed to treated borated water. The GALL-SLR Report recommends a plant-specific AMP be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. ~~The GALL Report references Licensee Event Report (LER) 50-275/94-023 for evidence of erosion.~~ Further evaluation is recommended to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position ~~RSLB~~(BTP) RLSB-1 (Appendix A.1 of this SRP~~-LR~~-SLR Report).

3.2.2.2.~~5~~4 Loss of Material Due to General Corrosion and Flow Blockage Due to Fouling ~~that Leads to Corrosion~~

Loss of material due to general corrosion and flow blockage due to ~~general corrosion and~~ fouling ~~that leads to corrosion~~ can occur ~~for steel~~in the spray nozzles and flow orifices in the drywell and suppression chamber spray system ~~nozzle and flow orifice internal surfaces~~ exposed to air~~-~~–indoor uncontrolled. ~~This could result in plugging~~ This aging effect and mechanism will apply since the carbon steel piping upstream of the spray nozzles and flow orifices~~. This aging mechanism and effect will apply since the spray nozzles and flow orifices are~~ is occasionally wetted, even though the majority of the time this system is ~~on~~in standby. The wetting and drying of these components can accelerate corrosion ~~and fouling.~~in the system and lead to flow blockage from an accumulation of corrosion products. The GALL-SLR Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in ~~Branch Technical Position RSLB~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.2.2.2.~~6~~5 Cracking Due to Stress Corrosion Cracking

Cracking due to ~~stress corrosion cracking~~SCC could occur for ~~stainless steel~~SS piping, piping components, ~~piping elements~~ and tanks exposed to outdoor air~~.~~ or any air environment when the component is insulated. The possibility of cracking also extends to indoor components ~~exposed~~located in close proximity to sources of outdoor air ~~which has recently been introduced into buildings, i.~~(e.~~,~~ .g., components near intake vents~~.~~). Cracking is ~~only~~ known to occur in environments containing sufficient halides (~~primarily~~e.g., chlorides) and in which ~~condensation or deliquescence~~moisture is possible.

~~Condensation or deliquescence should generally be assumed to be possible.~~ Applicable outdoor air environments (and associated local indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, ~~those~~ within 1/2 mile of a ~~highway~~road which is treated with salt in the wintertime, ~~those~~ areas in which the soil contains more than trace chlorides, ~~those~~ plants having cooling towers where the water is treated with chlorine or chlorine compounds, and ~~those~~ areas subject to chloride contamination from other agricultural or industrial sources. ~~This item is applicable for the~~

Insulated SS components exposed to indoor air environments ~~described above.~~ and outdoor air environments are susceptible to SCC if the insulation contains certain contaminants. Leakage of fluids through bolted connections (e.g., flanges, valve packing) can result in contaminants present in the insulation leaching onto the component surface. For outdoor insulated SS components, rain and changing weather conditions can result in moisture intrusion of the insulation.

~~GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect.~~ The applicant may demonstrate that ~~this item~~SCC is not expected to occur by one or more of the following applicable ~~by~~means.

- For outdoor uninsulated components, describing the outdoor air environment present at the plant and demonstrating that ~~external chloride stress corrosion cracking is not expected.~~ SCC is not expected.
- For underground components, the applicant may demonstrate that SCC due to exposure to in-leakage to the vault as a result of external precipitation or groundwater is not expected.
- For insulated components, determining that the insulation does not contain sufficient contaminants to cause SCC. One acceptable means to demonstrate this is provided by Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel."
- For indoor components, determining that there are no liquid-filled systems with threaded or bolted connections (e.g., flanges, valve packing) that could leak onto the component.
- For all components, demonstrating that the aggressive environment is not present by isolating the component from the environment using a barrier to prevent loss of material due to pitting or crevice corrosion. An acceptable barrier includes tightly-adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating a component from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," is an acceptable method to manage the integrity of a barrier coating for internal or external coatings.

The GALL-SLR Report recommends further evaluation to determine whether an ~~aging management program~~AMP is needed to manage this aging effect based on the environmental conditions applicable to the plant and requirements applicable to the components. GALL-SLR AMP XI.M36, "External Surfaces Monitoring," GALL-SLR AMP XI.M29, "Aboveground Metallic Tanks," or AMP XI.M41, "Buried and Underground Piping and Tanks," (for underground components) are acceptable methods to manage cracking of SS due to SCC in piping, piping components, and tanks.

3.2.2.2.~~7~~6 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in ~~Branch Technical Position~~BTP IQMB-1 (Appendix A.2 of this SRP-~~LR.)~~SLR Report).

3.2.2.2.7 Ongoing Review of Operating Experience

Acceptance criteria are described in Appendix A.4, "Operating Experience for Aging Management Programs."

3.2.2.2.8 Loss of Material Due to Recurring Internal Corrosion

Recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL-SLR Report. During the search of plant-specific operating experience conducted during the SLRA development, recurring internal corrosion can be identified by the number of occurrences of aging effects and the extent of degradation at each localized corrosion site. This further evaluation item is applicable if the search of plant-specific operating experience reveals repetitive occurrences [e.g., one per refueling outage cycle that has occurred: (a) in any three or more cycles for a 10-year operating experience search, or (b) in any two or more cycles for a 5-year operating experience search] of aging effects with the same aging mechanism in which the aging effect resulted in the component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness).

The GALL-SLR Report recommends that a plant-specific AMP, or a new or existing AMP, be evaluated for inclusion of augmented requirements to ensure the adequate management of any recurring aging effect(s). Potential augmented requirements include: alternative examination methods (e.g., volumetric versus external visual), augmented inspections (e.g., a greater number of locations, additional locations based on risk insights based on susceptibility to aging effect and consequences of failure, a greater frequency of inspections), and additional trending parameters and decision points where increased inspections would be implemented. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report)."

The applicant states: (a) why the program's examination methods will be sufficient to detect the recurring aging effect before affecting the ability of a component to perform its intended function, (b) the basis for the adequacy of augmented or lack of augmented inspections, (c) what parameters will be trended as well as the decision points where increased inspections would be implemented (e.g., the extent of degradation at individual corrosion sites, the rate of degradation change), (d) how inspections of components that are not easily accessed (i.e., buried, underground) will be conducted, and (e) how leaks in any involved buried or underground components will be identified.

Plant-specific operating experience examples should be evaluated to determine if the chosen AMP should be augmented even if the thresholds for significance of aging effect or frequency of occurrence of aging effect have not been exceeded. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the current licensing basis (CLB) intended functions of the component will be met throughout the subsequent period of extended operation. Likewise, the GALL-SLR Report AMR items associated with the new further evaluation items only cite raw water and waste water environments because operating experience indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific operating experience reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

3.2.2.2.9 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

Cracking due to SCC and intergranular stress corrosion cracking (IGSCC) could occur in BWR SS and nickel alloy piping and piping components greater than or equal to 4 inches nominal pipe size (NPS); nozzle safe ends and associated welds; and control rod drive return line nozzle caps and the associated cap-to-nozzle welds or cap-to-safe end welds in BWR-3, BWR-4, BWR-5, and BWR-6 designs that are exposed to reactor coolant. The GALL-SLR Report recommends GALL-SLR Report AMP XI.M2, "Water Chemistry," to mitigate SCC and IGSCC and augmented inspection activities in accordance with GALL-SLR Report AMP XI.M7, “BWR Stress Corrosion Cracking,” for condition monitoring. However, these programs may need to be augmented to manage the effects of cracking in dead-legs and other piping locations with stagnant flow where localized environmental conditions could exacerbate the mechanisms of SCC and IGSCC. The GALL-SLR Report recommends further evaluation to identify any such locations and to evaluate the adequacy of the applicant’s proposed AMPs on a case-by-case basis to ensure that the intended functions of components in these locations will be maintained during the subsequent period of extended operation. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

3.2.2.2.10 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

SCC is a form of environmentally assisted cracking which is known to occur in high and moderate strength aluminum alloys. The three conditions necessary for SCC to occur in a component are a sustained tensile stress, aggressive environment, and material with a susceptible microstructure. The aging effect of cracking due to SCC can be mitigated by eliminating one of the three necessary conditions. For the purposes of subsequent license renewal (SLR), acceptance criteria for this further evaluation is being provided for demonstrating that the specific material is not susceptible to SCC or an aggressive environment is not present. The susceptibility of the material is to be established prior to evaluating the environment. This further evaluation item is applicable unless it is demonstrated by the applicant that one of the two necessary conditions discussed below is absent.

Susceptible Material: If the material that a component is constructed of is not susceptible to SCC then the aging effect is not applicable. The microstructure of an aluminum alloy, of which alloy composition is only one factor, is what determines if the alloy is susceptible to SCC. Therefore, providing guidance based on alloy composition will not always successfully protect against SCC in aluminum alloys. The temper, condition, and product form of the alloy is considered when assessing if a material is susceptible to SCC. Aluminum alloys that are susceptible to SCC include:

- 2xxx series alloys in the F, W, Ox, T3x, T4x, or T6x temper
- 5xxx series alloys with a magnesium content of 3.5 weight percent or greater
- 6xxx series alloys in the F temper
- 7xxx series alloys in the F, T5x, or T6x temper
- 2xx.x and 7xx.x series alloys
- 3xx.x series alloys that contain copper
- 5xx.x series alloys with a magnesium content of greater than 8 weight percent

The material is evaluated to verify that it is not susceptible to SCC and that the basis used to make the determination is technically substantiated. Tempers have been specifically developed to improve the SCC resistance for some aluminum alloys. Aluminum alloy and temper combination which are not susceptible to SCC when used in piping, piping component, and tank applications include 1xxx series, 3xxx series, 6061-T6x, and 5454-x.

GALL-SLR Report AMP XI.M29, “Aboveground Metallic Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in tanks. GALL-SLR Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” is an acceptable method to manage cracking of aluminum due to SCC in piping and piping components. GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in piping and tanks which are buried or underground. GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components” is an acceptable method to manage cracking of aluminum due to SCC in components that are not included in other AMPs. Additional acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR).

Aggressive Environment: If the environment that an aluminum alloy is exposed to is not aggressive, such as dry gas, controlled indoor air, or treated water, then cracking due to SCC will not occur and the aging effect is not applicable. Aggressive environments that are known to result in cracking of susceptible aluminum alloys due to SCC are aqueous solutions and atmospheric air that contain halides (e.g., chloride). Halide concentrations should generally be considered high enough to facilitate SCC of aluminum alloys in uncontrolled or untreated aqueous solutions and atmospheric air, such as outdoor air, raw water, waste water, and condensation, unless demonstrated otherwise. If an aluminum component is encapsulated in a secondary material, such as insulation or concrete, the composition of the encapsulating material is evaluated for halides. The environment that the aluminum alloy is exposed to is evaluated to verify that it is either controlled or treated and free of halides.

An alternative strategy to demonstrating that an aggressive environment is not present is to isolate the aluminum alloy from the environment using a barrier to prevent SCC. Acceptable barriers include tightly adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating an aluminum alloy from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” or equivalent program is an acceptable method to manage the integrity of a barrier coating.

3.2.2.2.11 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking

Loss of material due to general (steel only), crevice, or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) can occur in steel and SS piping and piping components exposed to concrete. Concrete provides a high alkalinity environment that can mitigate the effects of loss of material for steel piping, thereby significantly reducing the corrosion rate. However, if water intrudes through the concrete, the pH can be reduced and ions that promote loss of material such as chlorides, which can penetrate the protective oxide layer created in the high alkalinity environment, can reach the surface of the metal. Carbonation can reduce the pH within concrete. The rate of carbonation is reduced by using concrete with a low water-to-cement ratio and low permeability. Concrete with low permeability also reduces the potential for the penetration of water. Adequate air entrainment improves the ability of the concrete to resist freezing and thawing cycles and therefore reduces the potential for cracking and intrusion of water. Intrusion of water can also bring bacteria to the surface of the metal, potentially resulting in microbiologically-induced corrosion in steel or SS. Cracking due to SCC, as well as pitting and crevice corrosion can occur due to halides present in the water that penetrates to the surface of the metal.

If the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to groundwater. For SS components loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage these aging effects.

3.2.2.2.12 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

Loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 ppb. In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

Where oxygen levels are less than or equal to 100 ppb, GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M32, “One-Time Inspection,” are acceptable methods to manage loss of material due to pitting and crevice corrosion. Where oxygen levels are greater than 100 ppb, GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” are acceptable methods to manage loss of material due to crevice corrosion. Where stagnant flow conditions exist, and oxygen levels are greater than 100 ppb and halides or sulfates levels are greater than 150 ppb, GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” are acceptable methods to manage loss of material due to pitting and crevice corrosion.

Where the pH is greater than or equal to 10.5 and the temperature is greater than or equal to 99 °C [210°F], GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M32, “One-Time Inspection,” are acceptable methods to manage loss of material due to loss of material due to microbiologically-induced corrosion. Where the pH is less than 10.5 and temperature is less than 99 °C [210°F], GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” are acceptable methods to manage loss of material due to microbiologically-induced corrosion.

3.2.2.2.13 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

Loss of material due to pitting and crevice corrosion could occur in aluminum piping, piping components, and tanks exposed to an air environment for a sufficient duration of time. Air environments known to result in pitting and/or crevice corrosion of aluminum alloys are those that contain halides (e.g., chloride) and periodic moisture. The moisture level and halide concentration in atmospheric and uncontrolled air are greatly dependent on geographical location and site-specific conditions. Moisture level and halide concentration should generally be considered high enough to facilitate pitting and/or crevice corrosion of aluminum alloys in atmospheric and uncontrolled air, unless demonstrated otherwise. The periodic introduction of moisture or halides into an air environment from secondary sources should also be considered. Leakage of fluids from mechanical connections, such as bolted flanges and valve packing, through insulation onto a component in indoor controlled air is an example of a secondary source that should be considered. The operating experience (OE) and condition of aluminum alloy components are evaluated to determine if the plant-specific air environment is aggressive enough to result in pitting and crevice corrosion after prolonged exposure. The aging effect of loss of material due to pitting and crevice corrosion in aluminum alloys is not applicable and does not require management if: (a) the plant-specific OE does not reveal a history of pitting or crevice corrosion and (b) a one-time inspection demonstrates that the aging effect is not occurring or that loss of material due to pitting or crevice corrosion is occurring so slowly that it will not affect the intended function of the components.

The internal surfaces of aluminum components do not need to be inspected if: (a) the review of OE does not reveal a history of pitting or crevice corrosion; and (b) inspection results for external surfaces demonstrate that the aging effect is not applicable. Inspection results associated with the periodic introduction of moisture or halides from secondary sources may be treated as a separate population of components. In the environment of air-indoor controlled, pitting and crevice corrosion is only expected to occur as the result of secondary source of moisture or halides. Alloy susceptibility may be considered when reviewing OE and interpreting inspection results. Inspections focus on the most susceptible alloys and locations.

The GALL-SLR Report recommends the further evaluation of aluminum piping, piping components, and tanks exposed to an air environment to determine whether an AMP is needed to manage the aging effect of loss of material due to pitting and crevice corrosion. GALL-SLR Report AMP XI.M32, "One-Time Inspection," is an acceptable method to demonstrate that the aging effect of loss of material due to pitting and crevice corrosion is not occurring at a rate that affects the intended function of the components. If loss of material due to pitting or crevice corrosion has occurred and is sufficient to potentially affect the intended function of an aluminum SSC, the following AMPs are acceptable methods to manage loss of material due to pitting or crevice corrosion: (i) GALL-SLR Report AMP XI.M29, "Aboveground Metallic Tanks," for tanks; (ii) GALL-SLR Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," for external surfaces of piping and piping components; (iii) GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," for underground piping, piping components and tanks; and (iv) GALL-SLR Report Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" for internal surfaces of components that are not included in other aging management programs.

3.2.2.3 Aging Management Review Results Not Consistent With or Not Addressed in the ~~GALL~~ Generic Aging Lessons Learned for Subsequent License Renewal Report

Acceptance criteria are described in ~~Branch Technical Position~~BTP RSLB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

3.2.2.4 Aging Management Programs

For those AMPs that will be used for aging management and are based on the program elements of an AMP in the GALL-SLR Report, the NRC reviewer performs an audit of ~~aging management programs~~AMPs credited in the ~~LRA~~SLRA to confirm consistency with the GALL-SLR AMPs identified in the GALL-SLR Report, Chapters X and XI.

If the applicant identifies an exception to any of the program elements of the cited GALL-SLR Report AMP, the ~~LRA~~SLRA AMP should include a basis demonstrating how the criteria of 10 CFR 54.21(a)(3) would still be met. The NRC reviewer should then confirm that the ~~LRA~~SLRA AMP with all exceptions would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the ~~LRA~~SLRA AMP, the reviewer identifies a difference between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP that should have been identified as an exception to the GALL-

SLR Report AMP, the difference should be reviewed and properly dispositioned. The reviewer should document the disposition of all ~~LRA~~SLRA-defined exceptions and NRC staff-identified differences.

The ~~LRA~~SLRA should identify any enhancements that are needed to permit an existing AMP to be declared consistent with the GALL-SLR Report AMP to which the ~~LRA~~SLRA AMP is compared. The reviewer is to confirm both that the enhancement, when implemented, would allow the existing plant AMP to be consistent with the GALL-SLR Report AMP and also that the applicant has a commitment in the FSAR Supplement to implement the enhancement prior to the subsequent period of extended operation. The reviewer should review and document the disposition of all enhancements.

If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1.2.3 of this SRP-~~LR~~SLR Report).

3.2.2.5 ~~FSAR~~Final Safety Analysis Report Supplement

The summary description of the programs and activities for managing the effects of aging for the subsequent period of extended operation in the FSAR Supplement should be sufficiently comprehensive, such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects will be managed during the subsequent period of extended operation. The description should also contain any future aging management activities, including enhancements and commitments, to be completed before the subsequent period of extended operation. Table 3.0-1 of this SRP~~-LR~~ SLR Report provides examples of the type of information to be included in the FSAR Supplement. Table 3.2-2 lists the programs that are applicable for this SRP-~~LR~~SLR subsection.

3.2.3 Review Procedures

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

3.2.3.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The applicant may reference the GALL-SLR Report in its ~~LRA~~SLRA, as appropriate, and demonstrate that the AMRs and AMPs at its facility are consistent with those reviewed and approved in the GALL-SLR Report. The reviewer should not conduct a re-review of the substance of the matters described in the GALL-SLR Report. If the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL-SLR Report, the reviewer should find acceptable the applicant's reference to the GALL-SLR Report in its ~~LRA.~~SLRA. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the ~~applicant has stated that the~~ applicable aging effects ~~and~~have been addressed based on the NRC staff's review of industry and plant-specific operating experience ~~have been reviewed by the applicant and are evaluated in the GALL Report~~.

Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL-SLR Report. Performance of this review requires the reviewer to confirm that the applicant has identified those aging effects for the engineered safety features system components that are contained in the GALL-SLR Report as applicable to its plant.

3.2.3.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic review procedures defined in Subsection 3.2.3.1 need to be applied first to all of the AMRs and AMPs provided in this section. In addition, if the GALL-SLR Report AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that “further evaluation is recommended,” then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations.

3.2.3.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The NRC staff reviews the evaluation of this TLAA separately, following the guidance in Section 4.3 of this SRP-~~LR~~SLR.

3.2.3.2.2 Loss of Material Due to ~~Cladding Breach~~Pitting and Crevice Corrosion

The GALL-SLR Report recommends further evaluation to manage loss of material due to pitting and crevice corrosion of SS piping, piping components, and tanks exposed to outdoor air or any air environment when the component is insulated where the presence of sufficient halides (e.g., chlorides) and moisture is possible. The possibility of pitting and crevice corrosion also extends to indoor components located in close proximity to sources of outdoor air (e.g., components near intake vents).

If the applicant claims that neither the environment nor composition of the insulation will result in loss of material due to pitting and crevice corrosion, the reviewer should evaluate the applicant’s data to verify that sufficient halides will not be present on the surface of the SS piping, piping components, or tanks. If the applicant elects to manage loss of material due to pitting or crevice corrosion, the reviewer should determine whether an adequate program is credited to manage the aging effect based on the applicable environmental conditions.

3.2.3.2.3 Loss of Material Due to Erosion

The GALL-SLR Report recommends further evaluation of programs to manage loss of material due to ~~cladding breach for PWR steel charging~~erosion of the SS high pressure safety injection pump ~~casings with stainless steel cladding. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks, and recommends further evaluation of~~ minimum flow orifice. The reviewer reviews the applicant’s proposed program on a ~~plant-specific program~~ case-by-case basis to ensure that ~~the~~ an adequate program will be in place to manage this aging effect.

3.2.3.2.4 Loss of Material Due to General Corrosion and Flow Blockage Due to Fouling

The GALL-SLR Report recommends further evaluation of programs to manage loss of material due to general corrosion and flow blockage due to fouling in the spray nozzles and flow orifices of the drywell and suppression chamber spray system spray exposed to air—indoor uncontrolled. This is ~~adequately managed.~~necessary to prevent the plugging of spray nozzles and flow orifices of the BWR drywell and suppression chamber spray system. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of loss of material due to general corrosion and flow blockage due to fouling of these components.

3.2.3.2.~~3 Loss of Material~~5 Cracking Due to ~~Pitting and Crevice~~Stress Corrosion Cracking

~~1.~~ The GALL-SLR Report recommends further evaluation ~~of programs to manage the loss of material due to pitting and crevice corrosion for partially encased stainless steel tanks exposed to raw water. The GALL Report specifically recommends that the program address the bottom of partially encased stainless steel tanks because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of loss of material due to pitting and crevice corrosion of these components~~

~~The GALL Report recommends further evaluation to manage loss of material due to pitting and crevice corrosion of stainless steel~~to manage cracking due to SCC of SS and aluminum piping, piping components, ~~piping elements,~~ and tanks exposed to outdoor air environments containing sufficient halides (~~primarily~~e.g., chlorides) and in which condensation ~~or deliquescence~~ is possible. The possibility of ~~pitting and crevice corrosion~~cracking also extends to components exposed to air which has recently been introduced into buildings~~,~~ (i.e., components near intake vents~~.~~.)

~~The reviewer should determine whether an adequate program is credited to manage the aging effect based on the applicable environmental conditions. Pitting and crevice corrosion is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above. The use of GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect.~~

~~1.1.1.1.7 3.2.3.2.4 Loss of Material due to Erosion~~

~~The GALL Report recommends further evaluation of programs to manage loss of material due to erosion of the stainless steel high pressure safety injection pump miniflow orifice. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place to manage this aging effect.~~

~~1.1.1.1.8 3.2.3.2.5 Loss of Material due to General Corrosion and Fouling that Leads to Corrosion~~

~~The GALL Report recommends further evaluation of programs to manage loss of material due to general corrosion and fouling that leads to corrosion for steel drywell and suppression chamber spray system spray nozzles and orifices exposed to air - indoor uncontrolled. This is necessary to prevent the plugging of spray nozzles and spargers of the BWR drywell and suppression chamber spray system. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of loss of material due to general corrosion and fouling of these components.~~

If the applicant claims that neither the environment nor composition of insulation will result in stress corrosion cracking, the reviewer should evaluate the applicant's data to verify that sufficient halides will not be present on the surface of the SS piping, piping components, or tanks. If the applicant elects to manage stress corrosion cracking, the reviewer should determine whether an adequate program is credited to manage the aging effect based on the applicable environmental conditions.

~~1.1.1.1.9~~ *3.2.3.2.6* ~~*Cracking due to Stress Corrosion Cracking*~~

~~The GALL Report recommends further evaluation to manage cracking due to stress corrosion cracking of stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. The possibility of cracking also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents.~~

~~The reviewer should determine whether an adequate program is credited to manage the aging effect based on the applicable environmental conditions. Cracking is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above. The use of GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect.~~

~~3.2.3.2.7~~ *Quality Assurance for Aging Management of Nonsafety-Related Components*

The applicant's AMPs for ~~license renewal~~SLR should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an ~~aging management review~~AMR for ~~license renewal.~~SLR. Nevertheless, the applicant has the 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 the applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR Supplement. If the applicant chooses alternative means, the branch responsible for quality assurance (QA) should be requested to review the applicant's proposal on a case-by-case basis.

3.2.3.~~3~~ ~~AMR Results Not Consistent with~~ *2.7 Ongoing Review of Operating Experience*

The applicant's AMPs should contain the element of operating experience. The reviewer verifies that the applicant has appropriate programs or ~~Not Addressed~~ processes for the ongoing review of both plant-specific and industry operating experience concerning age-related degradation and aging management. Such reviews are used to ensure that the AMPs are effective to manage the aging effects for which they are created. The AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Additional information is in Appendix A.4, "Operating Experience for AMPs."

3.2.3.2.8 Loss of Material Due to Recurring Internal Corrosion

The GALL-SLR Report recommends further evaluation to manage recurring internal corrosion aging effects. The reviewer conducts an independent review of plant-specific operating experience to determine whether the plant is currently experiencing recurring internal corrosion. The scope of this further evaluation AMR item includes recurring aging effects in which the plant-specific operating experience review reveals repetitive occurrences (e.g., one per refueling outage that has occurred over: (a) three or more sequential or nonsequential cycles for a 10-year operating experience search, or (b) two or more sequential or nonsequential cycles for a 5-year operating experience search) of aging effects with the same aging mechanism as a result of which the component either did not meet plant-specific acceptance criteria or experienced a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness).

The reviewer should evaluate plant specific operating experience examples to determine if the chosen AMP should be augmented. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the CLB intended functions of the component will be met throughout the subsequent period of extended operation. Likewise, the GALL-SLR Report AMR items associated with the new further evaluation items only cite raw water and waste water environments because operating experience indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific operating experience reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

The reviewer determines whether a proposed program is adequate to manage recurring internal corrosion by evaluating the proposed AMP against the criteria in SRP-SLR Section 3.2.2.2.8.

3.2.3.2.9 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

The GALL-SLR Report recommends review of plant-specific AMPs for managing cracking due to SCC and IGSCC in BWR SS and nickel alloy piping and piping components greater than or equal to 4 inches NPS; nozzle safe ends and associated welds; and control rod drive return line nozzle caps and the associated cap-to-nozzle welds or cap-to-safe end welds in BWR-3, BWR-4, BWR-5, and BWR-6 designs that are exposed to reactor coolant. Components in dead-legs and other piping locations with stagnant flow may be subject to localized environmental conditions that could exacerbate the mechanisms of SCC and IGSCC. The reviewer ensures that the applicant has identified any such locations and provided justification for the AMPs credited for managing this aging effect. The reviewer reviews the applicant's justification and proposed AMPs on a case-by-case basis to ensure that the effects of aging will be adequately managed.

3.2.3.2.10 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

The GALL-SLR Report recommends the further evaluation of aluminum components (i.e., piping, piping components, and tanks) exposed to atmospheric air or aqueous solutions that contain halides to manage cracking due to SCC. The reviewer must first determine if the aging effect of cracking due to SCC is applicable and requires aging management. The aging effect of cracking is to be considered applicable unless it is demonstrated that one of the two acceptance criteria are met by demonstrating that an aggressive environment is not present or the specific material is not susceptible, as discussed in Section 3.2.2.2.10. Additionally, guidance is also provided on the review of the third condition necessary for SCC to occur, a sustained tensile stress. Each of three conditions is evaluated based on the review procedures below.

If the material used to fabricate the component being evaluated is not susceptible to SCC then the aging effect of cracking due to SCC is not applicable and does not require aging management. When determining if an aluminum alloy is susceptible to SCC the reviewer is to verify the material’s (a) alloy composition, (b) condition or temper, and (c) product form. Additionally, if the material was produced using a process specifically developed to provide a SCC resistant microstructure then the reviewer will consider the effects of this processing in the review. Once the material information has been established the reviewer is to evaluate the technical justification used to substantiate that the material is not susceptible to SCC when exposed to an aggressive environment and sustained tensile stress. The reviewer will evaluate all documentation and references used by the applicant as part of a technical justification.

If the environment that an aluminum alloy is exposed to is not aggressive, such as dry gas, controlled indoor air, or treated water, then the aging effect of cracking due to SCC is not applicable and does not require aging management. The environments cited in the AMR items in the GALL-SLR Report that reference this further evaluation are considered to be aggressive and potentially containing halide concentrations that facilitate SCC of aluminum alloys. The reviewer is to verify that components are not also periodically exposed to nontypical environments that would be categorized as aggressive, such as outdoor air which has recently been introduced into a building and the leakage/seepage of untreated aqueous solutions into a building or underground vault. Using information provided by the applicant, the reviewer will also evaluate the chemical composition of applicable encapsulating materials (e.g., concrete, insulation) for halides.

If a barrier coating is employed to effectively isolate the aluminum alloy from an aggressive environment then the aging effect of cracking due to SCC is not applicable and does not require aging management. The reviewer is to verify that the barrier coating is impermeable to the plant-specific aqueous solutions and atmospheric air that the coating is intended to protect the alloy from being exposed to. If operating experience is cited as a technical justification for the effectiveness of a barrier coating the reviewer is to verify that the applicant has a program to manage loss of coating integrity equivalent to GALL-SLR Report AMP XI.M42.

If the sustained tensile stress being experienced by a component is below the SCC threshold value then cracking will not occur and the aging effect is not applicable. Many aluminum alloys do not have a true SCC threshold stress, although a practical SCC threshold value can be determined based on the material, service environment, and duration of intended function. The basis for the SCC threshold value is to be evaluated to determine its applicability. The magnitude of the maximum tensile service stress (applied and residual) experienced by the component is to be evaluated to verify that the stress levels are bounded by the SCC threshold value.

The information necessary to eliminate the aging effect of SCC based on the sustained service stress is often not readily available. The SCC threshold stress level is dependent on both the alloy (e.g., chemical composition, processing history, and microstructure) and service environment. Furthermore, the magnitude and state of the residual stress sustained by a component is typically not fully characterized. The reviewer must determine the adequacy of both the SCC threshold value being used by the applicant and the magnitude of the tensile stress being experienced by the component. The evaluation of the SCC threshold value includes the verification that the (a) test method used to establish the threshold value is standardized and recognized by the industry, (b) data are statistically significant or conservative, and (c) data are for a relevant alloy, temper, product form, and environment. The evaluation of the tensile stress being experienced by the component includes the verification that the stress analysis accounts for (e) all applied and residual stresses and (f) stress raiser that can initiate SCC cracks, such as corrosion pits and fabrication defects.

Documentation that may assist the reviewer in determining if the aging effect of cracking due to SCC is applicable and requires aging management include (a) component drawings, (b) applicable codes or specifications used in the design, fabrication, and installation of the component, (c) material-specific material certification data and lot release data, and (d) maintenance records and plant-specific operating experience.

If it is determined that the aging effect of cracking due to SCC is applicable the reviewer is to evaluate the applicants proposed AMP to ensure that the effects of aging on components are adequately managed so that their intended functions will be maintained consistent with the CLB for the subsequent period of extended operation. GALL-SLR Report AMP XI.M29, “Aboveground Metallic Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in tanks. GALL-SLR Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” is an acceptable method to manage cracking of aluminum due to SCC in piping and piping components. GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in piping and tanks which are buried or underground. GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components” is an acceptable method to manage cracking of aluminum due to SCC in components that are not included in other AMPs.

3.2.3.2.11 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking

The GALL-SLR Report recommends that for steel piping and piping components exposed to concrete, if the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to ground water. For SS piping and piping components, loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report

AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage these aging effects.

The reviewer verifies that the concrete was specified to meet ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557. The reviewer should evaluate plant-specific operating experience to determine whether concrete degradation sufficient to allow water intrusion has occurred.

3.2.3.2.12 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

The GALL-SLR Report recommends that loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 ppb. In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

The reviewer verifies the applicant’s chemistry control parameters to determine whether GALL-SLR Report AMP XI.M2, “Water Chemistry,” and a one-time inspection program is implemented (e.g., GALL-SLR Report AMP XI.M32, “One-Time Inspection”) or GALL-SLR Report AMP XI.M2, “Water Chemistry,” and a periodic inspection program is implemented (e.g., GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”) to manage loss of material.

3.2.3.2.13 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

The GALL-SLR Report recommends a further evaluation to determine whether an AMP is needed to manage the aging effect of loss of material due to pitting and crevice corrosion of aluminum piping, piping components, and tanks exposed to an air environment. If the applicant claims that a search of 10 years of plant-specific did not reveal any instances of loss of material due to pitting and crevice corrosion exposed to air environments, the staff conducts an independent review of plant-specific operating experience during the AMP audit.

An alternative strategy to demonstrating that pitting and crevice corrosion is not applicable is to isolate the aluminum alloy from the air environment using a barrier. Acceptable barriers include anodization and tightly adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating an aluminum alloy from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impermeable to the plant-specific environment. GALL-SLR Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” is an acceptable method to manage the integrity of internal and external barrier coatings.

The reviewer is to verify that the SLRA cites the use of GALL-SLR AMP XI.M32, "One-Time Inspection,” for all aluminum piping, piping components, and tanks exposed to air environments.

Alternatively, if the applicant states that it will utilize a strategy of isolating the aluminum components from the environment, verify that the aluminum components are coated and GALL-SLR AMP XI.M42 has been cited to manage loss of coating integrity.

3.2.3.3 Aging Management Review Results Not Consistent With or Not Addressed in the Generic Aging Lessons Learned for Subsequent License Renewal Report

The reviewer should confirm that the applicant, in its ~~LRA~~SLRA, has identified applicable aging effects, listed the appropriate combination of materials and environments, and AMPs that will adequately manage the aging effects. The AMP credited by the applicant could be an AMP that is described and evaluated in the GALL-SLR Report or a plant-specific program. Review procedures are described in ~~Branch Technical Position RSLB~~BTP RLSB-1 (Appendix A.1 of this SRP~~-LR~~-SLR Report).

3.2.3.4 Aging Management Programs

The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL-SLR Report. If the applicant commits to an enhancement to make its ~~LRA~~SLRA AMP consistent with a GALL-SLR Report AMP, then the reviewer is to confirm that this enhancement, when implemented, will make the ~~LRA~~SLRA AMP consistent with the GALL-SLR Report AMP. If the applicant identifies, in the ~~LRA~~SLRA AMP, an exception to any of the program elements of the GALL-SLR Report AMP, the reviewer is to confirm that the ~~LRA~~SLRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3). If the reviewer identifies a difference, not identified by the ~~LRA~~SLRA, between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP, with which the ~~LRA~~SLRA claims to be consistent, the reviewer should confirm that the ~~LRA~~SLRA AMP with this difference satisfies 10 CFR 54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions, or differences. The AMPs evaluated in the GALL-SLR Report pertinent to the engineered safety features components are summarized in Table 3.2-1 of this SRP-~~LR.~~SLR. The "~~Rev2~~GALL-SLR Item" ~~(for 2010) and "Rev1 Item" (for 2005 counterpart) columns identify~~ column identifies the AMR item numbers in the GALL-SLR Report, Chapter V, presenting detailed information summarized by this row.

Table 3.2-1 of this SRP-~~LR~~SLR may identify a plant-specific ~~aging management program.~~AMP. If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1.2.3 of this SRP~~-LR~~-SLR Report).

3.2.3.5 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer confirms that the applicant has provided in its FSAR supplement information equivalent to that in Table 3.0-1 of the applicable AMP for aging management of the engineered safety features. Table 3.2-2 lists the AMPs that are applicable for this SRP-~~LR~~SLR subsection. The reviewer also confirms that the applicant has provided information for Subsection 3.2.3.3, "AMR Results Not Consistent With or Not Addressed in the GALL-SLR Report," equivalent to that in Table 3.0-1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR Supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR Supplement without prior NRC approval, provided that the applicant evaluates each such change and finds it acceptable pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.

~~As noted in Table 3.0-1,~~ An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should confirm that the applicant has identified and committed in the ~~LRA~~SLRA to any future aging management activities, including enhancements and commitments, to be completed before entering the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

3.2.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of this section, then an evaluation finding similar to the following text should be included in the NRC staff's safety evaluation report:

> On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated that the aging effects associated with the engineered safety features systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).
>
> The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the engineered safety features systems, as required by 10 CFR 54.21(d).

3.2.5 Implementation

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

3.2.6 References

1. NRC. NUREG~~-~~–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition~~"~~." Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March 2007.

~~2. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

~~3. NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Nuclear Energy Institute, Revision 6.~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~1~~M	~~BWR/PWR~~ 1	~~Stainless steel, Steel Piping, piping components, and piping elements exposed to Treated water (borated)~~BWR/PWR	~~Cumulative fatigue damage~~ ~~due to fatigue~~Stainless steel, steel piping, piping components exposed to treated water, treated borated water	~~Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).~~Cumulative fatigue damage due to fatigue	~~Yes, TLAA (See subsection 3.2.2.2.1)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~V.D1.E-13~~ ~~V.D2.E-10~~ Yes (SRP-SLR Section 3.2.2.2.1)	V.D1~~-27(~~.E-13~~)~~ V.D2~~-32(~~.E-10~~)~~
~~2~~D	~~PWR~~2	~~Steel (with stainless steel cladding) Pump casings exposed to Treated water (borated)~~	~~Loss of material~~ ~~due to cladding breach~~	~~A plant-specific aging management program is to be evaluated~~ ~~Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."~~	~~Yes, verify that plant-specific program addresses clad breach (See subsection 3.2.2.2.2)~~	~~V.D1.EP-49~~	~~V.D1-32(EP-49)~~
~~3~~D	~~PWR~~3	~~Stainless steel Partially-encased tanks with breached moisture barrier~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~A plant-specific aging management program is to be evaluated for pitting and crevice~~	~~Yes, plant-specific (See subsection 3.2.2.2.3.1)~~	~~V.D1.E-01~~	~~V.D1-15(E-01)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~exposed to Raw water~~		~~corrosion of tank bottom because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.~~			
~~4~~M	~~BWR/PWR~~ 4	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel piping, piping components exposed to air – outdoor	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Loss of material due to pitting, crevice corrosion	~~Yes, environmental conditions need to be evaluated (See subsection 3.2.2.2.3.2)~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~V.B.EP-107~~ ~~V.C.EP-107~~ ~~V.D1.EP-107~~ ~~V.D2.EP-107~~ Yes (SRP-SLR Section 3.2.2.2.2)	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ V.B.EP-107 V.C.EP-107 V.D1.EP-107 V.D2.EP-107
~~5~~M	~~PWR~~5	~~Stainless steel Orifice (miniflow recirculation) exposed to Treated water (borated)~~PWR	~~Loss of material due to erosion~~Stainless steel orifice (miniflow recirculation) exposed to treated borated water	~~A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal~~	~~Yes,~~ Plant-specific ~~(See subsection 3.2.2.2.4)~~aging management program	~~V.D1.E-24~~ Yes (SRP-SLR Section 3.2.2.2.3)	V.D1~~-14(~~.E-24~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~charging. See LER 50-275/94-023 for evidence of erosion.~~Loss of material due to erosion			
~~6~~M	~~BWR~~6	~~Steel Drywell and suppression chamber spray system (internal surfaces): flow orifice; spray nozzles exposed to Air – indoor, uncontrolled (Internal)~~BWR	~~Loss of material due to general corrosion; fouling that leads to corrosion~~Steel drywell and suppression chamber spray system (internal surfaces): flow orifice; spray nozzles exposed to air – indoor uncontrolled (internal)	~~A plant-specific aging management program is to be evaluated~~Loss of material due to general corrosion; flow blockage due to fouling	~~Yes,~~ Plant-specific ~~(See subsection 3.2.2.2.5)~~aging management program	~~V.D2.EP-113~~ Yes (SRP-SLR Section 3.2.2.2.4)	V.D2~~-1(E-04)~~ .EP-113
~~7~~M	~~BWR/PWR~~ 7	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor~~BWR/PWR	~~Cracking due to stress corrosion cracking~~Stainless steel piping, piping components exposed to air – outdoor	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Cracking due to stress corrosion cracking	~~Yes, environmental conditions need to be evaluated (See subsection 3.2.2.2.6)~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~V.B.EP-103~~ ~~V.C.EP-103~~ ~~V.D1.EP-103~~ ~~V.D2.EP-103~~ Yes (SRP-SLR Section 3.2.2.2.5)	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ V.B.EP-103 V.C.EP-103 V.D1.EP

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							-103 V.D2.EP-103
~~8~~M	~~PWR~~8	~~Aluminum, Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements exposed to Air with borated water leakage~~PWR	~~Loss of material due to boric acid corrosion~~Aluminum, copper alloy (>15% Zn) piping, piping components exposed to air with borated water leakage	~~Chapter XI.M10, "Boric Acid Corrosion"~~Loss of material due to boric acid corrosion	~~No~~AMP XI.M10, "Boric Acid Corrosion"	~~V.D1.EP-101~~ ~~V.E.EP-38~~ No	V.~~D2-18(~~D1.EP-~~2)~~ 101 V.E~~-11(~~.EP-38~~)~~
~~9~~	~~PWR~~9	~~Steel External surfaces, Bolting exposed to Air with borated water leakage~~PWR	~~Loss of material due to boric acid corrosion~~Steel external surfaces, bolting exposed to air with borated water leakage	~~Chapter XI.M10, "Boric Acid Corrosion"~~Loss of material due to boric acid corrosion	~~No~~AMP XI.M10, "Boric Acid Corrosion"	~~V.A.E-28~~ ~~V.D1.E-28~~ ~~V.E.E-28~~ ~~V.E.E-41~~ No	V.A~~-4(~~.E-28~~)~~ V.D1~~-1(~~.E-28~~)~~ V.E~~-9(~~.E-28~~)~~ V.E~~-2(~~.E-41~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~10~~M	~~BWR/PWR~~ 10	~~Cast austenitic stainless steel Piping, piping components, and piping elements exposed to Treated water (borated) >250°C (>482°F), Treated water >250°C (>482°F)~~BWR/PWR	~~Loss of fracture toughness~~ ~~due to thermal aging embrittlement~~Cast austenitic stainless steel piping, piping components exposed to treated borated water >250°C (>482°F), treated water >250°C (>482°F)	~~Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"~~Loss of fracture toughness due to thermal aging embrittlement	~~No~~AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	~~V.D1.E-47~~ ~~V.D2.E-11~~ No	V.D1~~-16(~~.E-47~~)~~ V.D2~~-20(~~.E-11~~)~~
~~11~~M	~~BWR~~11	~~Steel Piping, piping components, and piping elements exposed to Steam, Treated water~~BWR	~~Wall thinning~~ ~~due to flow-accelerated corrosion~~Steel piping, piping components exposed to steam, treated water	~~Chapter XI.M17, "Flow-Accelerated Corrosion"~~Wall thinning due to flow-accelerated corrosion	~~No~~AMP XI.M17, "Flow-Accelerated Corrosion"	~~V.D2.E-07~~ ~~V.D2.E-09~~ No	V.D2~~-31(~~.E-07~~)~~ V.D2~~-34(~~.E-09~~)~~
~~12~~	~~BWR/PWR~~ 12	~~Steel, high-strength Closure bolting exposed to Air with steam or water leakage~~BWR/PWR	~~Cracking~~ ~~due to cyclic loading, stress corrosion cracking~~Steel, high-strength closure bolting exposed to air with steam or water leakage	~~Chapter XI.M18, "Bolting Integrity"~~Cracking due to cyclic loading, stress corrosion cracking	~~No~~AMP XI.M18, "Bolting Integrity"	~~V.E.E-03~~ No	V.E~~-3(~~.E-03~~)~~

Table 3.2-1.	**Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report**						
~~ID~~New (N), Modified (M), Deleted (D) Item	**~~Type~~ID**	**~~Component~~Type**	**~~Aging Effect/Mechanism~~Component**	**Aging ~~Management Programs~~Effect/Mechanism**	**~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA**	**~~Rev2 Item~~Further Evaluation Recommended**	**~~Rev1~~GALL-SLR Item**
~~13~~	~~BWR/PWR~~ 13	~~Steel; stainless steel Bolting, Closure bolting exposed to Air – outdoor (External), Air – indoor, uncontrolled (External)~~BWR/PWR	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor uncontrolled (external)	~~Chapter XI.M18, "Bolting Integrity"~~Loss of material due to general (steel only), pitting, crevice corrosion	~~No~~AMP XI.M18, "Bolting Integrity"	~~V.E.EP-64~~ ~~V.E.EP-70~~ No	V.E~~-1(~~.EP-~~1)~~ 64 V.E~~-4(~~.EP-~~25)~~ 70
~~14~~	~~BWR/PWR~~ 14	~~Steel Closure bolting exposed to Air with steam or water leakage~~BWR/PWR	~~Loss of material due to general corrosion~~Steel closure bolting exposed to air with steam or water leakage	~~Chapter XI.M18, "Bolting Integrity"~~Loss of material due to general corrosion	~~No~~AMP XI.M18, "Bolting Integrity"	~~V.E.E-02~~ No	V.E~~-6(~~.E-02~~)~~
~~15~~M	~~BWR/PWR~~ 15	~~Copper alloy, Nickel alloy, Steel; stainless steel, Stainless steel, Steel; stainless steel Bolting, Closure bolting exposed to Any environment, Air – outdoor (External), Raw water, Treated borated water, Fuel oil, Treated water, Air – indoor, uncontrolled (External)~~BWR/PWR	~~Loss of preload due to thermal effects, gasket creep, and self-loosening~~Copper alloy, nickel alloy, steel; stainless steel; bolting, closure bolting exposed to any environment, air – outdoor (external), raw water, waste water, treated borated water, fuel oil, treated water,	~~Chapter XI.M18, "Bolting Integrity"~~Loss of preload due to thermal effects, gasket creep, or self-loosening	~~No~~AMP XI.M18, "Bolting Integrity"	~~V.E.EP-116~~ ~~V.E.EP-117~~ ~~V.E.EP-118~~ ~~V.E.EP-119~~ ~~V.E.EP-120~~ ~~V.E.EP-121~~ ~~V.E.EP-122~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

Table 3.2-1.	Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL~~-~~SLR Report						
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			air – indoor uncontrolled (external)			~~V.E.EP-69~~ No	~~V.E-5(EP-24)~~ V.E.EP-116 V.E.EP-117 V.E.EP-118 V.E.EP-119 V.E.EP-120 V.E.EP-121 V.E.EP-122 V.E.EP-69
~~16~~M	~~BWR/PWR~~ 16	~~Steel Containment isolation piping and components (Internal surfaces), Piping, piping components, and piping elements exposed to Treated water~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel Containment isolation piping and components (Internal surfaces), Piping, piping components exposed to treated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~V.C.EP-62~~ ~~V.D2.EP-60~~ No	V.C~~-6(E-31)~~.EP-62 V.D2~~-33(E-08)~~.EP-60

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~17~~M	~~BWR~~17	~~Aluminum, Stainless steel Piping, piping components, and piping elements exposed to Treated water~~BWR	~~Loss of material due to pitting and crevice corrosion~~Aluminum, stainless steel piping, piping components exposed to treated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to pitting, crevice corrosion, MIC (stainless steel only)	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~V.D2.EP-71~~ ~~V.D2.EP-73~~ No	V.D2~~-19(~~.EP-~~26)~~71 V.D2~~-28(~~.EP-~~32)~~73
~~18~~M	~~BWR/PWR~~ 18	~~Stainless steel Containment isolation piping and components (Internal surfaces) exposed to Treated water~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel containment isolation piping and components (internal surfaces) exposed to treated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to pitting, crevice corrosion, MIC	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~V.C.EP-63~~ No	V.C~~-4(E-33)~~.EP-63
~~19~~	~~BWR/PWR~~ 19	~~Stainless steel Heat exchanger tubes exposed to Treated water~~BWR/PWR	~~Reduction of heat transfer due to fouling~~Stainless steel heat exchanger tubes exposed to treated water, treated borated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Reduction of heat transfer due to fouling	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~V.A.EP-74~~ ~~V.D2.EP-74~~ No	V.A~~-16(EP-34)~~.E-20 V.D2~~-13(~~.EP-~~34)~~

Table 3.2-1~~.~~	Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report						
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							74 V.D1.E-20
~~20~~M	~~PWR~~20	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Treated water (borated) >60°C (>140°F)~~PWR	~~Cracking due to stress corrosion cracking~~Stainless steel piping, piping components, tanks exposed to treated borated water >60°C (>140°F)	~~Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~V.A.E-12~~ ~~V.D1.E-12~~ No	V.A~~-28(~~.E-12~~)~~ V.D1~~-31(~~.E-12~~)~~
~~21~~	~~PWR~~21	~~Steel (with stainless steel or nickel-alloy cladding) Safety injection tank (accumulator) exposed to Treated water (borated) >60°C (>140°F)~~PWR	~~Cracking due to stress corrosion cracking~~Steel (with stainless steel or nickel-alloy cladding) safety injection tank (accumulator) exposed to treated borated water >60°C (>140°F)	~~Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~V.D1.E-38~~ No	V.D1~~-33(~~.E-38~~)~~
~~22~~M	~~PWR~~22	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Treated water (borated)~~PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel piping, piping components, tanks	~~Chapter XI.M2, "Water Chemistry"~~Loss of material due to pitting, crevice corrosion, MIC	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~V.A.EP-41~~ ~~V.D1.EP-41~~ No	V.A~~-27(~~.EP-41~~)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			exposed to treated borated water				V.D1-~~30(~~.EP-41~~)~~
~~23~~M	~~BWR/PWR~~ 23	~~Steel Heat exchanger components, Containment isolation piping and components (Internal surfaces) exposed to Raw water~~BWR/PWR	~~Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion~~Steel heat exchanger components, containment isolation piping, components (internal surfaces) exposed to raw water	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~V.A.EP-90~~ ~~V.C.E-22~~ ~~V.D1.EP-90~~ ~~V.D2.EP-90~~ No	V.A-~~10(E-18)~~.EP-90 V.C-~~5(~~.E-22~~)~~ V.D1-~~7(E-18)~~.EP-90 V.D2-~~8(E-18)~~.EP-90
~~24~~M	~~PWR~~24	~~Stainless steel Piping, piping components, and piping elements exposed to Raw water~~PWR	~~Loss of material due to pitting, crevice, and microbiologically-influenced corrosion~~Stainless steel piping, piping components exposed to raw water	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~V.D1.EP-55~~ No	V.D1-~~25(~~.EP-55~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~25~~M	~~BWR/PWR~~ 25	~~Stainless steel Heat exchanger components, Containment isolation piping and components (Internal surfaces) exposed to Raw water~~BWR/PWR	~~Loss of material due to pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion~~Stainless steel heat exchanger components, containment isolation piping, components (internal surfaces) exposed to raw water	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Loss of material due to pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~V.A.EP-91~~ ~~V.C.E-34~~ ~~V.D1.EP-91~~ ~~V.D2.EP-91~~ No	V.A~~-8(E-20)~~.EP-91 V.C~~-3(~~.E-34~~)~~ V.D1~~-5(E-20)~~.EP-91 V.D2~~-6(E-20)~~.EP-91
~~26~~	~~BWR~~26	~~Stainless steel Heat exchanger tubes exposed to Raw water~~BWR	~~Reduction of~~Stainless steel heat ~~transfer due~~exchanger tubes exposed to ~~fouling~~raw water	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Reduction of heat transfer due to fouling	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~V.D2.E-21~~ No	V.D2~~-12(~~.E-21~~)~~
~~27~~	~~BWR/PWR~~ 27	~~Stainless steel, Steel Heat exchanger tubes exposed to Raw water~~BWR/PWR	~~Reduction of~~Stainless steel, steel heat ~~transfer due~~exchanger tubes exposed to ~~fouling~~raw water	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Reduction of heat transfer due to fouling	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~V.A.E-21~~ ~~V.D1.E-21~~ ~~V.D2.E-23~~ No	V.A~~-15(~~.E-21~~)~~ V.D1~~-11(~~.E-21~~)~~

Table 3.2-1.   Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							V.D2-~~15(~~.E-23~~)~~
~~28~~M	~~BWR/PWR~~ 28	~~Stainless steel Piping, piping components, and piping elements exposed to Closed-cycle cooling water >60°C (>140°F)~~BWR/PWR	~~Cracking due to stress corrosion cracking~~Stainless steel piping, piping components exposed to closed- cycle cooling water >60°C (>140°F)	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~V.A.EP-98~~ ~~V.C.EP-98~~ ~~V.D1.EP-98~~ ~~V.D2.EP-98~~ No	V.A-~~24(~~.EP-~~44)~~ 98 V.C-~~8(~~.EP-~~44)~~ 98 V.D1-~~23(~~.EP-~~44)~~ 98 V.D2-~~26(~~.EP-~~44)~~ 98
~~29~~M	~~BWR/PWR~~ 29	~~Steel Piping, piping components, and piping elements exposed to Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping, piping components	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~V.C.EP-99~~ No	V.C-~~9(~~.EP-~~48)~~ 99

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			exposed to closed-cycle cooling water				
~~30~~M	~~BWR/PWR~~ 30	~~Steel Heat exchanger components exposed to Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to general, pitting, crevice, and galvanic corrosion~~Steel heat exchanger components exposed to closed-cycle cooling water	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~V.A.EP-92~~ ~~V.D1.EP-92~~ ~~V.D2.EP-92~~ No	V.A~~-9(E-17)~~.EP-92 V.D1~~-6(E-17)~~.EP-92 V.D2~~-7(E-17)~~.EP-92
~~31~~M	~~BWR/PWR~~ 31	~~Stainless steel Heat exchanger components, Piping, piping components, and piping elements exposed to Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel heat exchanger components, piping, piping components exposed to closed-cycle cooling water	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~V.A.EP-93~~ ~~V.A.EP-95~~ ~~V.C.EP-95~~ ~~V.D1.EP-93~~ ~~V.D1.EP-95~~ ~~V.D2.EP-93~~ ~~V.D2.EP-95~~ No	V.A~~-7(E-19)~~.EP-93 V.A~~-23(~~.EP-~~33)~~95 V.C~~-7(~~.EP-~~33)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							95 V.D1~~-4(E-19)~~ .EP-93 V.D1~~-22(~~.EP-~~33)~~ 95 V.D2~~-5(E-19)~~ .EP-93 V.D2~~-25(~~.EP-~~33)~~ 95
~~32~~M	~~BWR/PWR~~ 32	~~Copper alloy Heat exchanger components, Piping, piping components, and piping elements exposed to Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to pitting, crevice, and galvanic corrosion~~Copper alloy heat exchanger components, piping, piping components exposed to closed-cycle cooling water	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~V.A.EP-94 V.A.EP-97 V.B.EP-97 V.D1.EP-94 V.D1.EP-97 V.D2.EP-94~~	V.A~~-5(~~.EP-~~13)~~ 94 V.A~~-20(~~.EP-~~36)~~ 97 V.B~~-6(~~.EP-~~36)~~

Table 3.2-1~~.~~ Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~V.D2.EP-97~~ No	97 V.D1-~~2(~~.EP-~~13)~~ 94 V.D1-~~17(~~.EP-~~36)~~ 97 V.D2-~~3(~~.EP-~~13)~~ 94 V.D2-~~21(~~.EP-~~36)~~ 97
~~33~~	~~BWR/PWR~~ 33	~~Copper alloy, Stainless steel Heat exchanger tubes exposed to Closed-cycle cooling water~~BWR/PWR	~~Reduction of heat transfer~~ ~~due to fouling~~Copper alloy, stainless steel heat exchanger tubes exposed to closed-cycle cooling water	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Reduction of heat transfer due to fouling	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~V.A.EP-100~~ ~~V.A.EP-96~~ ~~V.D1.EP-96~~ ~~V.D2.EP-96~~ No	V.A-~~11(~~.EP-~~39)~~ 100 V.A-~~13(~~.EP-~~35)~~ 96 V.D1-

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~19(~~.EP-~~35)~~ 96 V.D2-~~10(~~.EP-~~35)~~ 96
~~34~~M	~~BWR/PWR~~ 34	~~Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements, Heat exchanger components exposed to Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to selective leaching~~Copper alloy (>15% Zn or >8% Al) piping, piping components, heat exchanger components exposed to closed-cycle cooling water, treated water	~~Chapter XI.M33, "Selective Leaching"~~Loss of material due to selective leaching	~~No~~AMP XI.M33, "Selective Leaching"	~~V.A.EP-27~~ ~~V.A.EP-37~~ ~~V.B.EP-27~~ ~~V.B.EP-37~~ ~~V.D1.EP-27~~ ~~V.D1.EP-37~~ ~~V.D2.EP-27~~ ~~V.D2.EP-37~~ No	V.A-~~22(~~.EP-27~~)~~ V.A-~~6(~~.EP-37~~)~~ V.B-~~7(~~.EP-27~~)~~ V.B-~~5(~~.EP-37~~)~~ V.D1-~~19(~~.EP-27~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							V.D1-~~3(~~.EP-37~~)~~ V.D2-~~23(~~.EP-27~~)~~ V.D2-~~4(~~.EP-37~~)~~
~~35~~M	~~PWR~~35	~~Gray cast iron Motor cooler exposed to Treated water~~PWR	~~Loss of material due to selective leaching~~Gray cast iron motor cooler exposed to Treated water, closed-cycle cooling water	~~Chapter XI.M33, "Selective Leaching"~~Loss of material due to selective leaching	~~No~~AMP XI.M33, "Selective Leaching"	~~V.A.E-43~~ ~~V.D1.E-43~~ No	V.A-~~18(~~.E-43~~)~~ V.D1-~~13(~~.E-43~~)~~
~~36~~M	~~PWR~~36	~~Gray cast iron Piping, piping components, and piping elements exposed to Closed-cycle cooling water~~PWR	~~Loss of material due to selective leaching~~Gray cast iron piping, piping components exposed to closed-cycle cooling water, treated water	~~Chapter XI.M33, "Selective Leaching"~~Loss of material due to selective leaching	~~No~~AMP XI.M33, "Selective Leaching"	~~V.D1.EP-52~~ No	V.D1-~~20(~~.EP-52~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~37~~M	~~BWR/PWR~~37	~~Gray cast iron Piping, piping components, and piping elements exposed to Soil~~BWR/PWR	~~Loss of material due to selective leaching~~Gray cast iron piping, piping components exposed to soil, ground water	~~Chapter XI.M33, "Selective Leaching"~~Loss of material due to selective leaching	~~No~~AMP XI.M33, "Selective Leaching"	~~V.B.EP-54~~ ~~V.D1.EP-54~~ ~~V.D2.EP-54~~ No	V.B~~-8(~~.EP-54~~)~~ V.D1~~-21(~~.EP-54~~)~~ V.D2~~-24(~~.EP-54~~)~~
~~38~~M	~~BWR~~38	~~Elastomers Elastomer seals and components exposed to Air – indoor, uncontrolled (External)~~BWR	~~Hardening and loss of strength due to elastomer degradation~~Elastomer seals, piping, piping components exposed to air – indoor uncontrolled (external)	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Hardening and loss of strength due to elastomer degradation	~~No~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~V.B.EP-59~~ No	V.B~~-4(E-06)~~ .EP-59
~~39~~M	~~BWR/PWR~~39	~~Steel Containment isolation piping and components (External surfaces) exposed to Condensation (External)~~BWR/PWR	~~Loss of material due to general corrosion~~Steel external surfaces exposed to condensation (external)	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Loss of material due to	~~No~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~V.C.E-30~~ ~~V.E.E-46~~ No	V.~~C-2(~~E~~-30)~~ ~~V~~.E-~~10(E-~~46~~)~~

Table 3.2-1.	Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-~~SLR~~SLR Report						
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				general, pitting, crevice corrosion			
~~40~~M	~~BWR/PWR~~ 40	~~Steel Ducting, piping, and components (External surfaces), Ducting, closure bolting, Containment isolation piping and components (External surfaces) exposed to Air – indoor, uncontrolled (External)~~BWR/PWR	~~Loss of material due to general corrosion~~Steel ducting, piping, components (external surfaces), ducting, closure bolting, containment isolation piping, components (external surfaces), external surfaces exposed to air – indoor uncontrolled (external)	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Loss of material due to general corrosion	~~No~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~V.A.E-26 V.B.E-26 V.B.E-40 V.C.E-35 V.D2.E-26 V.E.E-44~~ No	V.A~~-1(~~.E-26~~)~~ V.B~~-3(~~.E-26~~)~~ V.B~~-2(~~.E-40~~)~~ V.C~~-1(~~.E-35~~)~~ V.D2~~-2(~~.E-26~~)~~ V.E~~-7(~~.E-44~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~41~~	~~BWR/PWR~~ 41	~~Steel External surfaces exposed to Air – outdoor (External)~~BWR/PWR	~~Loss of material due to general corrosion~~Steel external surfaces exposed to air – outdoor (external)	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Loss of material due to general corrosion	~~No~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~V.E.E-45~~ No	V.E~~-8(~~.E-45~~)~~
~~42~~M	~~BWR/PWR~~ 42	~~Aluminum Piping, piping components, and piping elements exposed to Air - outdoor~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Aluminum piping, piping components exposed to air – outdoor	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~V.E.EP-114~~ No	~~N/A~~ V.E.EP-114
~~43~~M	~~BWR~~43	~~Elastomers Elastomer seals and components exposed to Air – indoor, uncontrolled (Internal)~~BWR	~~Hardening and loss of strength due to elastomer degradation~~Elastomer seals, piping, piping components exposed to air – indoor uncontrolled (internal)	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Hardening and loss of strength due to elastomer degradation	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~V.B.EP-58~~ No	V.B~~-4(E-06)~~ .EP-58
~~44~~	~~BWR/PWR~~ 44	~~Steel Piping and components (Internal surfaces), Ducting and components (Internal surfaces) exposed to Air –~~	~~Loss of material due to general corrosion~~Steel piping and components (internal surfaces),	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Loss of	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and	~~V.A.E-29~~ ~~V.B.E-25~~ ~~V.D2.E-29~~	V.A~~-19(~~.E-29~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~indoor, uncontrolled (Internal)~~BWR/PWR	ducting and components (internal surfaces) exposed to air – indoor uncontrolled (internal)	material due to general corrosion	Ducting Components"	No	V.B-~~1(~~.E-25~~)~~ V.D2-~~16(~~.E-29~~)~~
~~45~~	~~PWR~~45	~~Steel Encapsulation components exposed to Air – indoor, uncontrolled (Internal)~~PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel encapsulation components exposed to air – indoor uncontrolled (internal)	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~V.A.EP-42~~ No	V.A~~-2(~~.EP-42~~)~~
~~46~~	~~BWR~~46	~~Steel Piping and components (Internal surfaces) exposed to Condensation (Internal)~~BWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping and components (internal surfaces) exposed to condensation (internal)	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~V.D2.E-27~~ No	V.D2~~-17(~~.E-27~~)~~
~~47~~	~~PWR~~47	~~Steel Encapsulation components exposed to Air with borated~~	~~Loss of material due to general, pitting, crevice, and boric acid~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping~~	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous	~~V.A.EP-43~~ No	V.A~~-3(~~.EP-43~~)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
		~~water leakage (Internal)~~PWR	~~corrosion~~Steel encapsulation components exposed to air with borated water leakage (internal)	~~and Ducting Components"~~"Loss of material due to general, pitting, crevice, boric acid corrosion	Piping and Ducting Components"		
~~48~~M	~~BWR/PWR~~ 48	~~Stainless steel Piping, piping components, and piping elements (Internal surfaces); tanks exposed to Condensation (Internal)~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel piping, piping components (internal surfaces), tanks exposed to condensation (internal)	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~V.A.EP-81~~ ~~V.D1.EP-81~~ ~~V.D2.EP-61~~ No	V.A~~-26(~~.EP-~~53)~~ 81 V.D1~~-29(~~.EP-~~53)~~ 81 V.D2~~-35(E-14)~~ .EP-61
~~49~~M	~~BWR/PWR~~ 49	~~Steel Piping, piping components, and piping elements exposed to Lubricating oil~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping, piping components exposed to lubricating oil	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~V.A.EP-77~~ ~~V.D1.EP-77~~ ~~V.D2.EP-77~~ No	V.A~~-25(~~.EP-~~46)~~ 77 V.D1~~-28(~~.EP-~~46)~~ 77 V.D2~~-~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~30(~~.EP-~~46)~~ 77
~~50~~M	~~BWR/PWR~~ 50	~~Copper alloy, Stainless steel Piping, piping components, and piping elements exposed to Lubricating oil~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Copper alloy, stainless steel piping, piping components exposed to lubricating oil	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~V.A.EP-76~~ ~~V.D1.EP-76~~ ~~V.D1.EP-80~~ ~~V.D2.EP-76~~ No	V.A~~-21(~~.EP-~~45)~~ 76 V.D1~~-19(~~.EP-~~45)~~ 76 V.D1~~-24(~~.EP-~~51)~~ 80 V.D2~~-22(~~.EP-~~45)~~ 76
~~51~~	~~BWR/PWR~~ 51	~~Steel, Copper alloy, Stainless steel Heat exchanger tubes exposed to Lubricating oil~~BWR/PWR	~~Reduction of heat transfer due to fouling~~Steel, copper alloy, stainless steel heat exchanger	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~Reduction	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~V.A.EP-75~~ ~~V.A.EP-78~~ ~~V.A.EP-79~~	V.A~~-17(~~.EP-~~40)~~ 75 V.A~~-~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			tubes exposed to lubricating oil	of heat transfer due to fouling		~~V.D1.EP-75~~ ~~V.D1.EP-78~~ ~~V.D1.EP-79~~ ~~V.D2.EP-75~~ ~~V.D2.EP-78~~ ~~V.D2.EP-79~~ No	~~12(~~.EP-~~47)~~ 78 V.A-~~14(~~.EP-~~50)~~ 79 V.D1-~~12(~~.EP-~~40)~~ 75 V.D1-~~8(~~.EP-~~47)~~ 78 V.D1-~~10(~~.EP-~~50)~~ 79 V.D2-~~14(~~.EP-~~40)~~ 75 V.D2-~~9(~~.EP-~~47)~~

Table 3.2-1~~.~~ Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							78 V.D2~~-11(~~.EP-~~50)~~ 79
~~52~~M	~~BWR/PWR~~ 52	~~Steel (with coating or wrapping) Piping, piping components, and piping elements exposed to Soil or Concrete~~BWR/PWR	~~Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion~~Steel (with coating or wrapping) piping, piping components exposed to soil, concrete	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M41, "Buried and Underground Piping and Tanks"	~~V.B.EP-111~~ No	V.B~~-9(E-42)~~ .EP-111
~~53~~M	~~BWR/PWR~~ 53	~~Stainless steel Piping, piping components, and piping elements exposed to Soil or Concrete~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel, nickel alloy piping, piping components exposed to soil, concrete	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of material due to pitting, crevice corrosion, MIC (soil environment only)	~~No~~AMP XI.M41, "Buried and Underground Piping and Tanks"	~~V.D1.EP-72~~ ~~V.D2.EP-72~~ No	V.D1~~-26(~~.EP-~~31)~~ 72 V.D2~~-27(~~.EP-~~31)~~ 72

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
M	~~BWR/PWR~~ 53a	~~Steel; stainless steel Underground piping, piping components, and piping elements exposed to air-indoor uncontrolled or condensation (external)~~ BWR/PWR	~~Loss of material due to general (steel only), pitting and crevice corrosion~~Steel, nickel alloy underground piping, piping components exposed to air-indoor uncontrolled, condensation, air-outdoor, raw water	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of material due to general (steel only), pitting, crevice corrosion	~~No~~AMP XI.M41, "Buried and Underground Piping and Tanks"	~~V.E.EP-123~~No	V.E.EP-123
~~54~~M	~~BWR~~54	~~Stainless steel Piping, piping components, and piping elements exposed to Treated water >60°C (>140°F)~~BWR	~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking~~Stainless steel piping, piping components exposed to treated water >60°C (>140°F)	~~Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"~~Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	~~No~~AMP XI.M7, "BWR Stress Corrosion Cracking," and AMP XI.M2, "Water Chemistry"	~~V.D2.E-37~~ Yes (SRP-SLR Section 3.2.2.2.9)	V.D2~~-29(~~.E-37~~)~~
~~55~~M	~~BWR/PWR~~ 55	~~Steel Piping, piping components, and piping elements exposed to Concrete~~BWR/PWR	~~None~~Steel piping, piping components exposed to concrete	None~~, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air~~	~~No, if conditions are met.~~None	~~V.F.EP-112~~ Yes (SRP-SLR Section 3.2.2.2.11)	V.F~~-17(~~.EP-~~5)~~ 112

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~entrainment) as cited in NUREG-1557, and~~ ~~2) plant OE indicates no degradation of the concrete~~			
~~56~~M	~~BWR/PWR~~ 56	~~Aluminum Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (Internal/External)~~BWR/PWR	~~None~~Aluminum piping, piping components exposed to air – indoor uncontrolled (internal)	~~None~~Loss of material due to pitting, crevice corrosion	~~NA - No AEM or AMP~~Plant-specific aging management program	~~V.F.EP-3~~ Yes (SRP-SLR Section 3.2.2.2.13)	V.F~~-2(~~.EP-3~~)~~
~~57~~M	~~BWR/PWR~~ 57	~~Copper alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Gas~~BWR/PWR	~~None~~Copper alloy piping, piping components exposed to air – indoor uncontrolled (external), gas	None	~~NA - No AEM or AMP~~None	~~V.F.EP-10~~ ~~V.F.EP-9~~ No	V.F~~-3(~~.EP-10~~)~~ V.F~~-4(~~.EP-9~~)~~
~~58~~M	~~PWR~~58	~~Copper alloy (≤15% Zn and ≤8% Al) Piping, piping components, and piping elements exposed to Air with borated water leakage~~PWR	~~None~~Copper alloy piping, piping components exposed to air with borated water leakage	None	~~NA - No AEM or AMP~~None	~~V.F.EP-12~~ No	V.F~~-5(~~.EP-12~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~59~~M	~~BWR/PWR~~ 59	~~Galvanized steel Ducting, piping, and components exposed to Air – indoor, controlled (External)~~BWR/PWR	~~None~~Galvanized steel ducting, piping, and components exposed to air – indoor controlled (external)	None	~~NA - No AEM or AMP~~None	~~V.F.EP-14~~ No	V.F~~-1(~~.EP-14~~)~~
~~60~~M	~~BWR/PWR~~ 60	~~Glass Piping elements exposed to Air – indoor, uncontrolled (External), Lubricating oil, Raw water, Treated water, Treated water (borated), Air with borated water leakage, Condensation (Internal/External), Gas, Closed-cycle cooling water, Air – outdoor~~BWR/PWR	~~None~~Glass piping elements exposed to air – indoor uncontrolled (external), lubricating oil, raw water, treated water, treated borated water, air with borated water leakage, condensation (internal/external), gas, closed-cycle cooling water, air – outdoor	None	~~NA - No AEM or AMP~~None	~~V.F.EP-15~~ ~~V.F.EP-16~~ ~~V.F.EP-28~~ ~~V.F.EP-29~~ ~~V.F.EP-30~~ ~~V.F.EP-65~~ ~~V.F.EP-66~~ ~~V.F.EP-67~~ ~~V.F.EP-68~~ ~~V.F.EP-87~~ No	V.F~~-6(~~.EP-15~~)~~ V.F~~-7(~~.EP-16~~)~~ V.F~~-8(~~.EP-28~~)~~ V.F~~-10(~~.EP-29~~)~~ V.F~~-9(~~.EP-30~~)~~ ~~N/A~~ ~~N/A~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~N/A~~ ~~N/A~~ ~~N/A~~ V.F.EP-65 V.F.EP-66 V.F.EP-67 V.F.EP-68 V.F.EP-87
~~61~~M	~~BWR/PWR~~ 61	~~Nickel alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)~~BWR/PWR	~~None~~Nickel alloy piping, piping components exposed to air – indoor uncontrolled (external)	None	~~NA - No AEM or AMP~~None	~~V.F.EP-17~~ No	V.F~~-11(~~.EP-17~~)~~
~~62~~M	~~BWR/PWR~~ 62	~~Nickel alloy Piping, piping components, and piping elements exposed to Air with borated water leakage~~BWR/PWR	~~None~~Nickel alloy piping, piping components exposed to air with borated water leakage	None	~~NA - No AEM or AMP~~None	~~V.F.EP-115~~ No	~~N/A~~ V.F.EP-115

Table 3.2-1~~.~~ Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~63~~M	~~BWR/PWR~~ 63	~~Stainless steel Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Air with borated water leakage, Concrete, Gas, Air – indoor, uncontrolled (Internal)~~BWR/PWR	~~None~~Stainless steel piping, piping components exposed to air – indoor uncontrolled (external), air with borated water leakage, gas, air – indoor uncontrolled (internal)	None	~~NA - No AEM or AMP~~None	~~V.F.EP-18~~ ~~V.F.EP-19~~ ~~V.F.EP-20~~ ~~V.F.EP-22~~ ~~V.F.EP-82~~ No	V.F~~-12(~~.EP-18~~)~~ V.F~~-13(~~.EP-19~~)~~ V.F~~-14(EP-20)~~ ~~V.F-15(~~.EP-22~~)~~ ~~N/A~~ V.F.EP-82
~~64~~M	~~BWR/PWR~~ 64	~~Steel Piping, piping components, and piping elements exposed to Air – indoor, controlled (External), Gas~~BWR/PWR	~~None~~Steel piping, piping components exposed to air – indoor controlled (external), gas	None	~~NA - No AEM or AMP~~None	~~V.F.EP-4~~ ~~V.F.EP-7~~ No	V.F~~-16(~~.EP-4~~)~~ V.F~~-18(~~.EP-7~~)~~

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
M	65	BWR/PWR	Any material piping, piping components exposed to treated water, treated borated water	Wall thinning due to erosion	AMP XI.M17, "Flow-Accelerated Corrosion"	No	V.D1.E-407 V.D2.E-408
M	66	BWR/PWR	Metallic piping, piping components, tanks exposed to raw water, waste water	Loss of material due to recurring internal corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.2.2.2.9)	V.A.E-400 V.B.E-400 V.C.E-400 V.D1.E-400 V.D2.E-400
M	67	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	No	V.D1.E-405 V.D2.E-405
M	68	BWR/PWR	Steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete, air – outdoor, air – indoor uncontrolled, moist air, condensation	Loss of material due to general, pitting, crevice corrosion, MIC (soil environment only)	AMP XI.M29, "Aboveground Metallic Tanks"	No	V.D1.E-402 V.D2.E-402

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
M	69	BWR/PWR	Insulated steel, copper alloy, aluminum piping, piping components, tanks exposed to condensation, air – outdoor	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	V.E.E-403
M	70	BWR/PWR	Steel, stainless steel, aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to treated water, treated borated water	Loss of material due to general (steel only), pitting, crevice corrosion, MIC (steel and stainless steel only)	AMP XI.M29, "Aboveground Metallic Tanks"	No	V.A.E-404 V.D1.E-404 V.D2.E-404
M	71	BWR/PWR	Insulated copper alloy (> 15% Zn) piping, piping components, tanks exposed to condensation, air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	V.E.E-406
M	72	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	V.A.E-401 V.B.E-401 V.C.E-401 V.D1.E-401 V.D2.E-401

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
M	73	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion; cracking due to stress corrosion cracking	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	V.A.E-414 V.B.E-414 V.C.E-414 V.D1.E-414 V.D2.E-414
	74	BWR/PWR	Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	V.A.E-415 V.B.E-415 V.C.E-415 V.D1.E-415 V.D2.E-415
N	75	BWR/PWR	Steel, stainless steel bolting exposed to condensation, fuel oil, lubricating oil	Loss of preload due to thermal effects, gasket creep, or self-loosening	AMP XI.M18, "Bolting Integrity"	No	V.E.E-416 V.E.E-417
N	76	BWR/PWR	Copper alloy bolting exposed to raw water, waste water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M18, "Bolting Integrity"	No	V.E.E-418

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	77	BWR/PWR	Steel bolting exposed to lubricating oil, fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M18, "Bolting Integrity"	No	V.E.E-419
N	78	BWR/PWR	Stainless steel, aluminum piping, piping components exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	V.A.E-420 V.D1.E-420 V.D2.E-420
N	79	BWR/PWR	Stainless steel bolting exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	V.A.E-421 V.D1.E-421 V.D2.E-421
N	80	BWR/PWR	Stainless steel underground piping, piping components, tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.2.2.2.5)	V.B.E-423 V.C.E-423 V.D1.E-423 V.D2.E-423
N	81	BWR/PWR	Stainless steel, steel, aluminum, copper alloy, titanium heat exchanger components exposed to air, condensation (external)	Reduction of heat transfer due to fouling	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	V.E.E-424

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	83	BWR/PWR	Elastomer seals, piping, piping components exposed to air – outdoor	Hardening and loss of strength due to elastomer degradation	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	V.E.E-426
N	84	BWR/PWR	Elastomer seals, piping, piping components exposed to condensation	Hardening and loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	V.A.E-427 V.B.E-427 V.D1.E-427 V.D2.E-427
N	85	BWR/PWR	Nickel alloy piping, piping components, heat exchanger components exposed to treated water, treated borated water	Loss of material due to pitting, crevice corrosion, MIC	Plant-specific aging management program	Yes (SRP-SLR Section 3.2.2.2.12)	V.A.E-428 V.D1.E-428 V.D2.E-428
N	86	BWR/PWR	Steel, stainless steel bolting exposed to raw water, waste water, treated water, treated borated water	Loss of material due to general (steel only), pitting, crevice corrosion, MIC	AMP XI.M18, "Bolting Integrity"	No	V.E.E-430 V.E.E-429 V.E.E-431
N	87	BWR/PWR	Jacketed thermal insulation in an air – indoor uncontrolled, air – outdoor environment,	Reduced thermal insulation resistance due to moisture intrusion	AMP XI.M36, "External Surfaces Monitoring of	No	V.E.E-422

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			air with borated water leakage, air with reactor coolant leakage, air with steam or water leakage environment		Mechanical Components"		
N	89	BWR/PWR	Steel, stainless steel, nickel alloy, copper alloy, aluminum piping, piping components exposed to condensation	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	V.E.E-433
N	90	BWR/PWR	Steel components exposed to treated water, raw water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No	V.A.E-434 V.B.E-434 V.C.E-434 V.D1.E-434 V.D2.E-434
N	91	BWR/PWR	Stainless steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.2.2.2.11)	V.F.EP-20
N	92	BWR/PWR	Stainless steel, steel, aluminum, copper alloy, titanium heat exchanger components internal to	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and	No	V.A.E-435 V.B.E-435 V.D1.E-

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			components exposed to air, condensation		Ducting Components"		435 V.D2.E-435
N	95	PWR	Copper alloy (≤8% Al) piping, piping components exposed to air with borated water leakage	None	None	No	V.F.E-438
N	96	BWR/PWR	Stainless steel piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	V.D1.E-439
N	97	BWR	Steel piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	V.D2.E-440
N	98	BWR/PWR	Copper alloy (>15% Zn or >8% Al) piping, piping components exposed to soil ground water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No	V.D1.E-441 V.D2.E-441

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	99	BWR/PWR	Stainless steel tanks exposed to air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.2.2.2.2)	V.E.E-442
N	100	BWR/PWR	Aluminum piping, piping components exposed to air – outdoor, raw water, waste water, condensation (internal)	Cracking due to stress corrosion cracking	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes (SRP-SLR Section 3.2.2.2.10)	V.A.E-443 V.B.E-443 V.D1.E-443 V.D2.E-443
N	101	BWR/PWR	Aluminum piping, piping components exposed to air – outdoor, raw water, waste water, condensation (external)	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.2.2.2.10)	V.E.E-444
N	102	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to the following external environments: soil, concrete, air – outdoor, air – indoor uncontrolled, air – indoor controlled, condensation, raw water, waste water	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.2.2.2.10)	V.D1.E-445 V.D2.E-445

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~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	103	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air – outdoor, air – indoor uncontrolled, air – indoor controlled, moist air, condensation	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.2.2.2.5)	V.D1.E-446 V.D2.E-446
N	104	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	No	V.D1.E-447 V.D2.E-447
N	105	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air (external)	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.2.2.2.13)	V.D1.E-448 V.D2.E-448
N	106	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air – indoor uncontrolled, moist air, condensation, air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.2.2.2.2)	V.D1.E-449 V.D2.E-449

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	107	BWR/PWR	Insulated stainless steel tanks exposed to condensation, air – outdoor, air – indoor uncontrolled, air – indoor controlled	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.2.2.2.2)	V.E.E-450
N	108	BWR/PWR	Insulated stainless steel piping, piping components, tanks exposed to condensation, air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.2.2.2.5)	V.E.E-451
N	109	BWR/PWR	Insulated aluminum piping, piping components, tanks exposed to condensation, air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.2.2.2.10)	V.E.E-452
N	110	BWR/PWR	Aluminum underground piping, piping components, tanks exposed to air – outdoor, raw water, condensation	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.2.2.2.10)	V.B.E-453 V.C.E-453 V.D1.E-453 V.D2.E-453
N	111	BWR/PWR	Aluminum underground piping, piping components exposed to air (external)	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.2.2.2.13)	V.E.E-454

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	112	BWR/PWR	Stainless steel underground piping, piping components exposed to raw water	Loss of material due to pitting, crevice corrosion	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	V.E.E-455
N	113	BWR/PWR	Stainless steel underground piping, piping components exposed to air – indoor uncontrolled, condensation, air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.2.2.2.2)	V.E.E-456

Table 3.2-2. AMPs and Additional Guidance Appendices Recommended for Aging Management ~~Programs Recommended for~~ of Engineered Safety Features	
GALL-SLR Report Chapter/AMP	**Program Name**
~~Chapter~~AMP XI.M2	Water Chemistry
~~Chapter~~AMP XI.M7	~~BWR~~Boiling Water Reactor Stress Corrosion Cracking
~~Chapter~~AMP XI.M10	Boric Acid Corrosion
~~Chapter~~AMP XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
~~Chapter~~AMP XI.M17	Flow-Accelerated Corrosion ~~(FAC)~~
~~Chapter~~AMP XI.M18	Bolting Integrity
~~Chapter~~AMP XI.M20	Open-Cycle Cooling Water System
~~Chapter~~AMP XI.M21A	Closed Treated Water Systems
AMP XI.M29	Aboveground Metallic Tanks
~~Chapter~~AMP XI.M32	One-Time Inspection
~~Chapter~~AMP XI.M33	Selective Leaching
~~Chapter~~AMP XI.M36	External Surfaces Monitoring of Mechanical Components
~~Chapter~~AMP XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
~~Chapter~~AMP XI.M39	Lubricating Oil Analysis
~~Chapter~~AMP XI.M41	Buried and Underground Piping and Tanks
AMP XI.M42	Internal Coatings/Linings for In Scope Piping, Piping Components, Heat Exchangers, and Tanks
GALL-SLR Report Appendix ~~for GALL~~A	Quality Assurance for Aging Management Programs
GALL-SLR Report Appendix B	Operating Experience for Aging Management Programs
SRP-~~LR~~SLR Appendix A.1	Plant-Specific AMP

3.3 Aging Management of Auxiliary Systems

Review Responsibilities

Primary~~–~~—Branch assigned responsibility by Project Manager (PM) as described in Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-~~LR~~SLR) Section 3.0 of this SRP-~~LR~~SLR.

3.3.1 Areas of Review

This section addresses the aging management review (AMR) and the associated aging management program (AMP) of the auxiliary systems for subsequent license renewal~~.~~ (SLR). For a recent vintage plant, the information related to the auxiliary systems 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). The auxiliary systems contained in this review plan section are generally consistent with those contained in NUREG~~-~~–0800 except for refueling water, chilled water, heat removal, condenser circulating water, and condensate storage system. For older plants, the location of applicable information is plant-specific because an older plant's FSAR may have predated NUREG~~-~~–0800.

Typical auxiliary systems that are subject to an AMR for ~~license renewal~~SLR are new fuel storage, spent fuel storage, spent fuel pool cooling and cleanup [boiling water reactor/pressurized water reactor(BWR/PWR~~),~~)], suppression pool cleanup (BWR), overhead heavy load and light load (related to refueling) handling, open-cycle cooling water, closed-cycle cooling water, ultimate heat sink, compressed air, chemical and volume control (PWR), standby liquid control (BWR), reactor water cleanup (BWR), shutdown cooling (older BWR), control room area ventilation, auxiliary and radwaste area ventilation, primary containment heating and ventilation, diesel generator building ventilation, fire protection, diesel fuel oil, and emergency diesel generator. This review plan section also includes structures and components in nonsafety-related systems that are not connected to safety-related systems, structures, and components (SSCs) but have a spatial relationship such that their failure could adversely impact the performance of a safety-related SSC intended function. Examples of such ~~non-safety~~ nonsafety-related systems may be plant drains, liquid waste processing, potable/sanitary water, water treatment, process sampling, and cooling water systems.

Aging management is reviewed, following the guidance in this SRP-~~LR~~SLR Section 3.1, for portions of the chemical and volume control system for PWRs, and for standby liquid control, reactor water cleanup, and shutdown cooling systems extending up to the first isolation valve outside of containment for BWRs (the shutdown cooling systems for older BWRs). The following systems have portions that are classified as Group B quality standard: open-cycle cooling water (service water system), closed-cycle cooling water, compressed air, standby liquid control, shutdown cooling system (older BWR), control room area ventilation, and auxiliary and radwaste area ventilation. Aging management for these portions is reviewed following the guidance in Section 3.3. The ~~aging management program~~AMP for the cooling towers is reviewed following the guidance in Section 3.5 for "Group 6" structures.

The responsible review organization is to review the following ~~license renewal~~SLR application ~~(LRA)~~ AMR and AMP items assigned to it, per SRP-~~LR~~SLR Section 3.0:

AMRs

- AMR results consistent with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
- AMR results for which further evaluation is recommended ~~by the GALL Report~~
- AMR results not consistent with or not addressed in the GALL-SLR Report

AMPs

- Consistent with GALL-SLR Report AMPs
- Plant-specific AMPs

FSAR Supplement

- The responsible review organization is to review the FSAR Supplement associated with each assigned AMP.

3.3.2 Acceptance Criteria

The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the ~~NRC's~~U.S. Nuclear Regulatory Commission (NRC) regulations in 10 CFR 54.21.

3.3.2.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The AMR and the AMPs applicable to the auxiliary system features are described and evaluated in Chapter VII of ~~NUREG-1801 (~~the GALL-SLR Report~~)~~.

The applicant's ~~LRA~~subsequent license renewal application (SLRA) should provide sufficient information so that the NRC reviewer is able to confirm that the specific ~~LRA~~SLRA AMR item and the associated ~~LRA~~SLRA AMP are consistent with the cited GALL-SLR Report AMR item. The reviewer should then confirm that the ~~LRA~~SLRA AMR item is consistent with the GALL-SLR Report AMR item to which it is compared.

When the applicant is crediting a different ~~aging management program~~ AMP than recommended in the GALL-SLR Report, the reviewer should confirm that the alternate ~~aging management program~~AMP is valid to use for aging management and will be capable of managing the effects of aging as adequately as the ~~aging management program~~AMP recommended by the GALL-SLR Report.

3.3.2.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic acceptance criteria, defined in Subsection 3.3.2.1, need to be applied first for all of the AMRs and AMPs reviewed as part of this section. In addition, if the GALL-SLR Report AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.3-1, comparing the "Further Evaluation Recommended" and the "~~Rev2~~GALL-SLR Item" ~~columns~~column, for the AMR items that reference the following subsections. ~~The 2005 AMR item counterpart is provided in the "Rev1 Item" column.~~

3.3.2.2.1 Cumulative Fatigue Damage

Fatigue 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). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," or Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," of this SRP-~~LR~~SLR.

3.3.2.2.2 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

Cracking due to stress corrosion cracking (SCC) and cyclic loading could occur in stainless steel (SS) PWR ~~non-regenerative~~nonregenerative heat exchanger components exposed to treated borated water greater than 60 °C ~~(>~~[>140 °F~~)~~] in the chemical and volume control system. The existing ~~aging management program~~AMP on monitoring and control of primary water chemistry in PWRs manages the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL-SLR Report recommends that a plant-specific ~~aging management program~~AMP be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

Cracking due to ~~stress corrosion cracking~~SCC could occur for ~~stainless steel~~ SS piping, piping components, ~~piping elements~~ and tanks exposed to outdoor air~~.~~ or any air environment when the component is insulated. The possibility of cracking also extends to indoor components ~~exposed~~located in close proximity to ~~air which has recently been introduced into buildings, i.~~sources of outdoor air (e~~., ~~.g., components near intake vents~~.~~). Cracking is ~~only~~ known to occur in environments containing sufficient halides (~~primarily~~e.g., chlorides) and in which ~~condensation or deliquescence~~moisture is possible.

~~Condensation or deliquescence should generally be assumed to be possible.~~ Applicable outdoor air environments (and associated local indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, ~~those~~ within 1/2 mile of a ~~highway~~road which is treated with salt in the wintertime, ~~those~~ areas in which the soil contains more than trace chlorides, ~~those~~ plants having cooling towers where the water is treated with chlorine or chlorine compounds, and ~~those~~ areas subject to chloride contamination from other agricultural or industrial sources. ~~This item is applicable for the~~

Insulated SS components exposed to indoor air environments ~~described above.~~ and outdoor air environments are susceptible to SCC if the insulation contains certain contaminants. Leakage of fluids through bolted connections (e.g., flanges, valve packing) can result in contaminants present in the insulation leaching onto the component surface. For outdoor insulated SS components, rain and changing weather conditions can result in moisture intrusion of the insulation.

~~GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect.~~ The applicant may demonstrate that ~~this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external chloride stress corrosion cracking~~ SCC is not expected~~.~~ to occur by one or more of the following applicable means.

- For outdoor uninsulated components, describing the outdoor air environment present at the plant and demonstrating that SCC is not expected.
- For underground components, the applicant may demonstrate that SCC due to exposure to in-leakage to the vault as a result of external precipitation or groundwater is not expected.
- For insulated components, determining that the insulation does not contain sufficient contaminants to cause SCC. One acceptable means to demonstrate this is provided by Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel."
- For indoor components, determining that there are no liquid-filled systems with threaded or bolted connections (e.g., flanges, valve packing) that could leak onto the component.
- For all components, demonstrating that the aggressive environment is not present by isolating the component from the environment using a barrier to prevent loss of material due to pitting or crevice corrosion. An acceptable barrier includes tightly-adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating a component from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," is an acceptable method to manage the integrity of a barrier coating for internal or external coatings.

The GALL-SLR Report recommends further evaluation to determine whether an ~~adequate aging management program~~AMP is ~~used~~needed to manage this aging effect based on the environmental conditions applicable to the plant and ~~ASME Code Section XI~~ requirements applicable to the components. GALL-SLR AMP XI.M36, "External Surfaces Monitoring," GALL-SLR AMP XI.M29, "Aboveground Metallic Tanks," or AMP XI.M41, "Buried and Underground Piping and Tanks," (for underground components) are acceptable methods to manage cracking of SS due to SCC in piping, piping components, and tanks.

~~1.1.1.1.10~~ 3.3.2.2.4 Loss of Material Due to ~~Cladding Breach~~

~~Loss of material due to cladding breach could occur for PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks," and recommends further evaluation of a plant-specific aging management program to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).~~

~~3.3.2.2.5 Loss of Material due to~~ *Pitting and Crevice Corrosion*

Loss of material due to pitting and crevice corrosion could occur ~~for stainless steel piping,~~ in SS piping ~~components~~, piping ~~elements~~components, and tanks exposed to outdoor air~~.~~ or any air environment when the component is insulated or where the component is in the vicinity of insulated components. The possibility of pitting and crevice corrosion also extends to indoor components ~~exposed~~located in close proximity to sources of outdoor air ~~which has recently been introduced into buildings, i.~~(e.g., components near intake vents~~.~~). Pitting and crevice corrosion is ~~only~~ known to occur in environments containing sufficient halides (~~primarily~~e.g., chlorides) and in which ~~condensation or deliquescence~~the presence of moisture is possible.

~~Condensation or deliquescence should generally be assumed to be possible.~~ Applicable outdoor air environments (and associated local indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, ~~those~~ within 1/2 mile of a ~~highway~~road which is treated with salt in the wintertime, ~~those~~ areas in which the soil contains more than trace chlorides, ~~those~~ plants having cooling towers where the water is treated with chlorine or chlorine compounds, and ~~those~~ areas subject to chloride contamination from other agricultural or industrial sources.~~This item is applicable for the environments described above.~~

~~GALL AMP XI.M36, “External Surfaces Monitoring,” is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by~~Insulated SS components exposed to indoor air environments and outdoor air environments are susceptible to loss of material due to pitting or crevice corrosion if the insulation contains certain contaminants. Leakage of fluids through mechanical connections such as bolted flanges and valve packing can result in contaminants leaching onto the component surface. For outdoor insulated SS components, rain and changing weather conditions can result in moisture intrusion of the insulation.

The applicant may demonstrate that loss of material due to pitting and crevice corrosion is not expected to occur by one or more of the following applicable means.

- For outdoor uninsulated components, describing the outdoor air environment present at the plant and demonstrating that external pitting or crevice corrosion is not expected.
- For underground components, the applicant may demonstrate that loss of material due to pitting or crevice corrosion due to exposure to in-leakage to the vault as a result of external precipitation or groundwater is not expected.
- For insulated components, determining that the insulation does not contain sufficient contaminants to cause loss of material due to pitting or crevice corrosion. One acceptable means to demonstrate this is provided by Regulatory Guide 1.36, “Nonmetallic Thermal Insulation for Austenitic Stainless Steel.”
- For indoor components, determining that there are no liquid-filled systems with threaded or bolted connections (e.g., flanges, valve packing) that could leak onto the component.
- For all components, demonstrating that the aggressive environment is not present by isolating the component from the environment using a barrier to prevent loss of material due to pitting or crevice corrosion. An acceptable barrier includes coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating a component from a potentially aggressive environment, then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” is an acceptable method to manage the integrity of a barrier coating for internal or external coatings.

The GALL-SLR Report recommends further evaluation to determine whether an ~~adequate aging management program is used~~AMP is needed to manage this aging effect based on the environmental conditions applicable to the plant and ~~ASME Code Section XI~~ requirements applicable to the components. GALL-SLR AMP XI.M36, “External Surfaces Monitoring,” GALL-SLR AMP XI.M29, “Aboveground Metallic Tanks,” or AMP XI.M41, “Buried and Underground Piping and Tanks,” (for underground components) are acceptable methods to manage loss of material due to pitting and crevice corrosion in SS piping, piping components, and tanks.

3.3.2.2.5 Quality Assurance for Aging Management of Nonsafety-Related Components~~.~~

~~*1.1.1.1.11 3.3.2.2.6 Quality Assurance for Aging Management of Nonsafety-Related Components*~~

Acceptance criteria are described in Branch Technical Position (BTP) IQMB-1 ~~(~~ (Appendix A.2, of this SRP-SLR Report.)

3.3.2.2.6 Ongoing Review of Operating Experience

Acceptance criteria are described in Appendix A.~~2, of this SRP-LR.)~~

~~*1.1.1.2 3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report*~~

~~Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR.)~~

~~3.3.2.~~4, “Operating Experience for Aging Management Programs.”

3.3.2.2.7 Loss of Material Due to Recurring Internal Corrosion

Recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL-SLR Report. During the search of plant-specific operating experience (OE) conducted during the SLRA development, recurring internal corrosion can be identified by the number of occurrences of aging effects and the extent of degradation at each localized corrosion site. This further evaluation item is applicable if the search of plant-specific OE reveals repetitive occurrences (e.g., one per refueling outage cycle that has occurred over: (a) in any three or more—cycles for a 10-year OE search, or (b) in any two or more—cycles for a 5-year OE search) of aging effects with the same aging mechanism in which the aging effect resulted in the component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness).

The GALL-SLR Report recommends that a plant-specific AMP, or a new or existing AMP, be evaluated for inclusion of augmented requirements to ensure the adequate management of any recurring aging effect(s). Potential augmented requirements include: alternative examination methods (e.g., volumetric versus external visual), augmented inspections (e.g., a greater number of locations, additional locations based on risk insights based on susceptibility to aging effect and consequences of failure, a greater frequency of inspections), and additional trending parameters and decision points where increased inspections would be implemented. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1of this SRP-SLR Report).”

The applicant states: (a) why the program’s examination methods will be sufficient to detect the recurring aging effect before affecting the ability of a component to perform its intended function, (b) the basis for the adequacy of augmented or lack of augmented inspections, (c) what parameters will be trended as well as the decision points where increased inspections would be implemented (e.g., the extent of degradation at individual corrosion sites, the rate of degradation change), (d) how inspections of components that are not easily accessed (i.e., buried, underground) will be conducted, and (e) how leaks in any involved buried or underground components will be identified.

Plant-specific operating experience examples should be evaluated to determine if the chosen AMP should be augmented even if the thresholds for significance of aging effect or frequency of occurrence of aging effect have not been exceeded. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the current licensing basis (CLB) intended functions of the component will be met throughout the subsequent period of extended operation. Likewise, the GALL-SLR Report AMR items associated with the new further evaluation—items only cite raw water and waste water environments because OE indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific OE reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

3.3.2.2.8 Reduction in Impact Strength

Reduction in impact strength can occur in polyvinyl chloride (PVC) piping and piping components that have been exposed to sunlight 2 years or longer. If the piping had been wrapped with an opaque material or painted during installation, an AMP should include inspections of the condition of the wrap or paint. If the piping had not been wrapped or painted, a plant-specific program to address reduction in impact strength is recommended.

3.3.2.2.9 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

Cracking due to SCC and intergranular stress corrosion cracking (IGSCC) could occur in BWR SS and nickel alloy piping, piping components greater than or equal to 4 inches nominal pipe size; nozzle safe ends and associated welds; and control rod drive return line nozzle caps and the associated cap-to-nozzle welds or cap-to-safe end welds in BWR-3, BWR-4, BWR-5, and BWR-6 designs that are exposed to reactor coolant. The GALL-SLR Report recommends GALL-SLR Report AMP XI.M2, "Water Chemistry," to mitigate SCC and IGSCC and augmented inspection activities in accordance with GALL-SLR Report AMP XI.M7, "BWR Stress Corrosion Cracking," for condition monitoring. However, these programs may need to be augmented to manage the effects of cracking in dead-legs and other piping locations with stagnant flow where localized environmental conditions could exacerbate the mechanisms of SCC and IGSCC. The GALL-SLR Report recommends further evaluation to identify any such locations and to evaluate the adequacy of the applicant's proposed AMPs on a case-by-case basis to ensure that the intended functions of components in these locations will be maintained during the subsequent period of extended operation. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

3.3.2.2.10 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

SCC is a form of environmentally assisted cracking which is known to occur in high and moderate strength aluminum alloys. The three conditions necessary for SCC to occur in a component are a sustained tensile stress, aggressive environment, and material with a susceptible microstructure. The aging effect of cracking due to SCC can be mitigated by eliminating one of the three necessary conditions. For the purposes of SLR, acceptance criteria for this further evaluation is being provided for demonstrating that the specific material is not susceptible to SCC or an aggressive environment is not present. The susceptibility of the material is to be established prior to evaluating the environment. This further evaluation item is applicable unless it is demonstrated by the applicant that one of the two necessary conditions discussed below is absent.

Susceptible Material: If the material of a component is not susceptible to SCC then the aging effect is not applicable. The microstructure of an aluminum alloy, of which alloy composition is only one factor, is what determines if the alloy is susceptible to SCC. Therefore, providing guidance based on alloy composition will not always successfully protect against SCC in aluminum alloys. The temper, condition, and product form of the alloy is considered when assessing if a material is susceptible to SCC. Aluminum alloys that are susceptible to SCC include:

- 2xxx series alloys in the F, W, Ox, T3x, T4x, or T6x temper
- 5xxx series alloys with a magnesium content of 3.5 weight percent or greater
- 6xxx series alloys in the F temper
- 7xxx series alloys in the F, T5x, or T6x temper
- 2xx.x and 7xx.x series alloys
- 3xx.x series alloys that contain copper
- 5xx.x series alloys with a magnesium content of greater than 8 weight percent

The material is evaluated to verify that it is not susceptible to SCC and that the basis used to make the determination is technically substantiated. Tempers have been specifically developed to improve the SCC resistance for some aluminum alloys. Aluminum alloy and temper combination which are not susceptible to SCC when used in piping, piping component, and tank applications include 1xxx series, 3xxx series, 6061-T6x, and 5454-x.

GALL-SLR Report AMP XI.M29, “Aboveground Metallic Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in tanks. GALL-SLR Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” is an acceptable method to manage cracking of aluminum due to SCC in piping and piping components. GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in piping and tanks which are buried or underground. GALL-SLR Report AMP XI.M27, “Fire Water System,” is an acceptable method to manage cracking of aluminum due to SCC in fire water storage tanks. GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components” is an acceptable method to manage cracking of aluminum due to SCC in components that are not included in other AMPs. Additional acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

Aggressive Environment: If the environment that an aluminum alloy is exposed to is not aggressive, such as dry gas, controlled indoor air, or treated water, then cracking due to SCC will not occur and the aging effect is not applicable. Aggressive environments that are known to result in cracking of susceptible aluminum alloys due to SCC are aqueous solutions and atmospheric air that contain halides (e.g., chloride). Halide concentrations should generally be considered high enough to facilitate SCC of aluminum alloys in uncontrolled or untreated aqueous solutions and atmospheric air, such as outdoor air, raw water, waste water, and condensation, unless demonstrated otherwise. If an aluminum component is encapsulated in a secondary material, such as insulation or concrete, the composition of the encapsulating material is evaluated for halides. The environment that the aluminum alloy is exposed to is evaluated to verify that it is either controlled or treated and free of halides.

An alternative strategy to demonstrating that an aggressive environment is not present is to isolate the aluminum alloy from the environment using a barrier to prevent SCC. Acceptable barriers include tightly adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating an aluminum alloy from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” or equivalent program is an acceptable method to manage the integrity of a barrier coating.

3.3.2.2.11 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking

Loss of material due to general (steel only), crevice, or pitting corrosion, and microbiologically-induced corrosion and cracking due to SCC (SS only) can occur in steel and SS piping and piping components exposed to concrete. Concrete provides a high alkalinity environment that can mitigate the effects of loss of material for steel piping, thereby significantly reducing the corrosion rate. However, if water intrudes through the concrete, the pH can be reduced and ions that promote loss of material such as chlorides, which can penetrate the protective oxide layer created in the high alkalinity environment, can reach the surface of the metal. Carbonation can reduce the pH within concrete. The rate of carbonation is reduced by using concrete with a low water-to-cement ratio and low permeability. Concrete with low permeability also reduces the potential for the penetration of water. Adequate air entrainment improves the ability of the concrete to resist freezing and thawing cycles and therefore reduces the potential for cracking and intrusion of water. Intrusion of water can also bring bacteria to the surface of the metal, potentially resulting in microbiologically-induced corrosion in steel or SS. Cracking due to SCC, as well as pitting and crevice corrosion can occur due to halides present in the water that penetrates to the surface of the metal.

If the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with American Concrete Institute (ACI) 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to groundwater. For SS components loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice, or pitting corrosion, and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," is an acceptable method to manage these aging effects.

3.3.2.2.12 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

Loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 parts per billion (ppb). In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

Where oxygen levels are less than or equal to 100 ppb, GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M32, "One-Time Inspection," are acceptable methods to manage loss of material due to pitting and crevice corrosion. Where oxygen levels are greater than 100 ppb, GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," are acceptable methods to manage loss of material due to crevice corrosion. Where stagnant flow conditions exist, and oxygen levels are greater than 100 ppb and halides or sulfates levels are greater than 150 ppb, GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," are acceptable methods to manage loss of material due to pitting and crevice corrosion.

Where the pH is greater than or equal to 10.5 and the temperature is greater than or equal to 99 °C [210 °F], GALL-SLR Report AMP XI.M2, "Water Chemistry," and GALL-SLR Report AMP XI.M32, "One-Time Inspection," are acceptable methods to manage loss of material due to microbiologically-induced corrosion. Where the pH is less than 10.5 and temperature is less than 99 °C [210 °F], GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” are acceptable methods to manage loss of material due to MIC.

For tanks and spent fuel storage racks, due to the restricted accessibility for inspections, GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” is an acceptable method to manage loss of material due to pitting and crevice corrosion even though the surface exposed to the environment may not be an interior surface.

3.3.2.2.13 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

Loss of material due to pitting and crevice corrosion could occur in aluminum piping, piping components, and tanks exposed to an air environment for a sufficient duration of time. Air environments known to result in pitting and/or crevice corrosion of aluminum alloys are those that contain halides (e.g., chloride) and periodic moisture. The moisture level and halide concentration in atmospheric and uncontrolled air are greatly dependent on geographical location and site-specific conditions. Moisture level and halide concentration should generally be considered high enough to facilitate pitting and/or crevice corrosion of aluminum alloys in atmospheric and uncontrolled air, unless demonstrated otherwise. The periodic introduction of moisture or halides into an air environment from secondary sources should also be considered. Leakage of fluids from mechanical connections, such as bolted flanges and valve packing, through insulation onto a component in indoor controlled air is an example of a secondary source that should be considered. The operating experience (OE) and condition of aluminum alloy components are evaluated to determine if the plant-specific air environment is aggressive enough to result in pitting and crevice corrosion after prolonged exposure. The aging effect of loss of material due to pitting and crevice corrosion in aluminum alloys is not applicable and does not require management if: (a) the plant-specific OE does not reveal a history of pitting or crevice corrosion and (b) a one-time inspection demonstrates that the aging effect is not occurring or that loss of material due to pitting or crevice corrosion is occurring so slowly that it will not affect the intended function of the components.

The internal surfaces of aluminum components do not need to be inspected if: (a) the review of OE does not reveal a history of pitting or crevice corrosion; and (b) inspection results for external surfaces demonstrate that the aging effect is not applicable. Inspection results associated with the periodic introduction of moisture or halides from secondary sources may be treated as a separate population of components. In the environment of air-indoor controlled, pitting and crevice corrosion is only expected to occur as the result of secondary source of moisture or halides. Alloy susceptibility may be considered when reviewing OE and interpreting inspection results. Inspections focus on the most susceptible alloys and locations.

The GALL-SLR Report recommends the further evaluation of aluminum piping, piping components, and tanks exposed to an air environment to determine whether an AMP is needed to manage the aging effect of loss of material due to pitting and crevice corrosion. GALL-SLR Report AMP XI.M32, “One-Time Inspection,” is an acceptable method to demonstrate that the aging effect of loss of material due to pitting and crevice corrosion is not occurring at a rate that affects the intended function of the components. If loss of material due to pitting or crevice corrosion has occurred and is sufficient to potentially affect the intended function of an aluminum SSC, the following AMPs are acceptable methods to manage loss of material due to pitting or crevice corrosion: (i) GALL-SLR Report AMP XI.M29, “Aboveground Metallic Tanks,” for tanks; (ii) GALL-SLR Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," for external surfaces of piping and piping components; (iii) GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," for underground piping, piping components and tanks; and (iv) GALL-SLR Report Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" for internal surfaces of components that are not included in other aging management programs.

3.3.2.3 Aging Management Review Results Not Consistent With or Not Addressed in the Generic Aging Lessons Learned for Subsequent License Renewal Report

Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report.)

3.3.2.4 Aging Management Programs

For those AMPs that will be used for aging management and are based on the program elements of an AMP in the GALL-SLR Report, the NRC reviewer performs an audit of ~~aging management programs~~AMPs credited in the ~~LRA~~SLRA to confirm consistency with the GALL-SLR AMPs identified in the GALL-SLR Report, Chapters X and XI.

If the applicant identifies an exception to any of the program elements of the cited GALL-SLR Report AMP, the ~~LRA~~SLRA AMP should include a basis demonstrating how the criteria of 10 CFR 54.21(a)(3) would still be met. The NRC reviewer should then confirm that the ~~LRA~~SLRA AMP with all exceptions would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the ~~LRA~~SLRA AMP, the reviewer identifies a difference between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP that should have been identified as an exception to the GALL-SLR Report AMP, the difference should be reviewed and properly dispositioned. The reviewer should document the disposition of all ~~LRA~~SLRA-defined exceptions and NRC staff-identified differences.

The ~~LRA~~SLRA should identify any enhancements that are needed to permit an existing ~~LRA~~SLRA AMP to be declared consistent with the GALL-SLR Report AMP to which the ~~LRA~~SLRA AMP is compared. The reviewer is to confirm both that the enhancement, when implemented, would allow the existing ~~LRA AMP to be consistent with the GALL~~license renewal applications (LRA) AMP to be consistent with the GALL-SLR Report AMP and also that the applicant has a commitment in the FSAR Supplement to implement the enhancement prior to the subsequent period of extended operation. The reviewer should document the disposition of all enhancements.

If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of BTP RLSB-1 (Appendix A.1.2.3 of this SRP-SLR).

3.3.2.5 Final Safety Analysis Report Supplement

The summary description of the programs and activities for managing the effects of aging for the subsequent period of extended operation in the FSAR Supplement should be sufficiently comprehensive, such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects will be managed during the subsequent period of extended operation. The description should also contain any future aging management activities, including enhancements and commitments, to be completed before the period of extended operation. Table 3.3-2 lists the programs that are applicable for this SRP-SLR subsection.

3.3.3 Review Procedures

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

3.3.3.1 Aging Management Review Results Consistent With the Generic Aging Lessons Learned for Subsequent License Renewal Report

The applicant may reference the GALL-SLR Report in its SLRA, as appropriate, and demonstrate that the AMRs and AMPs at its facility are consistent with those reviewed and approved in the GALL-SLR Report. The reviewer should not conduct a re-review of the substance of the matters described in the GALL-SLR Report. If the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL-SLR Report, the reviewer should find acceptable the applicant's reference to the GALL-SLR Report in its SLRA. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the applicable aging effects have been addressed based in the staff's review of industry and plant-specific operating experience.

Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL-SLR Report. Performance of this review requires the reviewer to confirm that the applicant has identified those aging effects for the auxiliary system components that are contained in the GALL-SLR Report as applicable to its plant.

3.3.3.2 Aging Management Review Results Report for Which Further Evaluation Is Recommended by the Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic review procedures defined in Subsection 3.3.3.1 need to be applied first for all of the AMRs and AMPs provided in this section. In addition, if the GALL-SLR Report AMR item to which the SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.3-1 for the items that reference the following subsections.

3.3.3.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3 of this SRP-SLR.

3.3.3.2.2 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

The GALL-SLR Report also recommends further evaluation of programs to manage cracking due to SCC and cyclic loading in the SS nonregenerative heat exchangers in the chemical and volume control system (PWR) exposed to treated borated water >60 °C [>140 °F]. The water chemistry program relies on monitoring and control of water chemistry to manage the aging effects of cracking due to SCC and cyclic loading. The GALL-SLR Report recommends the effectiveness of the chemistry control program be verified to ensure that cracking is not occurring. The absence of cracking due to SCC and cyclic loading is to be verified. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.3.3.2.3 Cracking Due to Stress Corrosion Cracking

The GALL-SLR Report recommends further evaluation to manage cracking due to SCC of SS and aluminum piping, piping components, and tanks exposed to outdoor air environments containing sufficient halides (e.g., chlorides) and in which condensation is possible. The possibility of cracking also extends to components exposed to air which has recently been introduced into buildings (i.e., components near intake vents.)

If the applicant claims that neither the environment nor composition of insulation will result in stress corrosion cracking, the reviewer should evaluate the applicant's data to verify that sufficient halides will not be present on the surface of the SS piping, piping components, or tanks. If the applicant elects to manage stress corrosion cracking, the reviewer should determine whether an adequate program is credited to manage the aging effect based on the applicable environmental conditions.

3.3.3.2.4 Loss of Material Due to Pitting and Crevice Corrosion

The GALL-SLR Report recommends further evaluation to manage loss of material due to pitting and crevice corrosion of SS piping, piping components, and tanks exposed to outdoor air or any air environment when the component is insulated where the presence of sufficient halides (e.g., chlorides) and moisture is possible. The possibility of pitting and crevice corrosion also extends to indoor components located in close proximity to sources of outdoor air (e.g., components near intake vents).

If the applicant claims that neither the environment nor composition of the insulation will result in loss of material due to pitting and crevice corrosion, the reviewer should evaluate the applicant's data to verify that sufficient halides will not be present on the surface of the SS piping, piping components, or tanks. If the applicant elects to manage loss of material due to pitting or crevice corrosion, the reviewer should determine whether an adequate program is credited to manage the aging effect based on the applicable environmental conditions.

3.3.3.2.5 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's AMPs for SLR should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an AMR for SLR. Nevertheless, the applicant has the 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 the applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR Supplement. If the applicant chooses alternative means, the branch responsible for quality assurance (QA) should be requested to review the applicant's proposal on a case-by-case basis.

3.3.3.2.6 Ongoing Review of Operating Experience

The applicant's AMPs should contain the element of OE. The reviewer verifies that the applicant has appropriate programs or processes for the ongoing review of both plant-specific and industry OE concerning age-related degradation and aging management. Such reviews are used to ensure that the AMPs are effective to manage the aging effects for which they are created. The AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of OE that the effects of aging may not be adequately managed. Additional information is in Appendix A.4, "Operating Experience for Aging Management Programs."

3.3.3.2.7 Loss of Material Due to Recurring Internal Corrosion

The GALL-SLR Report recommends further evaluation to manage recurring internal corrosion aging effects. The reviewer conducts an independent review of plant-specific OE to determine whether the plant is currently experiencing recurring internal corrosion. The scope of this further evaluation AMR item includes recurring aging effects in which the plant-specific OE review reveals repetitive occurrences (e.g., one per refueling outage that has occurred over: (a) in any three or more cycles for a 10-year OE search, or (b) in any two or more cycles for a 5-year OE search) of aging effects with the same aging mechanism as a result of which the component either did not meet plant-specific acceptance criteria or experienced a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness).

The reviewer should evaluate plant-specific operating experience examples to determine if the chosen AMP should be augmented. For example, during a 10-year search of plant specific OE, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the OE should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the CLB intended functions of the component will be met throughout the subsequent period of extended operation. Likewise, the GALL-SLR Report AMR items associated with the new further evaluation (FE) items only cite raw water and waste water environments because OE indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific OE reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

The reviewer determines whether a proposed program is adequate to manage recurring internal corrosion by evaluating the proposed AMP against the criteria in SRP-SLR Section 3.3.2.2.7.

3.3.3.2.8 Reduction in Impact Strength

The reviewer should confirm that PVC piping and piping components, exposed to sunlight had been wrapped with an opaque material or painted during installation or determine whether an adequate program is used to manage reduction in impact strength for PVC piping exposed to sunlight. If the PVC piping and piping components exposed to sunlight had been wrapped with an opaque material or painted, the reviewer should confirm the adequacy of the program used to conduct inspections of the wrap or paint.

3.3.3.2.9 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

The GALL-SLR Report recommends review of plant-specific AMPs for managing cracking due to SCC and IGSCC in BWR SS and nickel alloy piping and piping components greater than or equal to 4 inches nominal pipe size; nozzle safe ends and associated welds; and control rod drive return line nozzle caps and the associated cap-to-nozzle welds or cap-to-safe end welds in BWR-3, BWR-4, BWR-5, and BWR-6 designs that are exposed to reactor coolant. Components in dead-legs and other piping locations with stagnant flow may be subject to localized environmental conditions that could exacerbate the mechanisms of SCC and IGSCC. The reviewer ensures that the applicant has identified any such locations and provided justification for the AMPs credited for managing this aging effect. The reviewer reviews the applicant's justification and proposed AMPs on a case-by-case basis to ensure that the effects of aging will be adequately managed.

3.3.3.2.10 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

The GALL-SLR Report recommends the further evaluation of aluminum components (i.e., piping, piping components, and tanks) exposed to atmospheric air or aqueous solutions that contain halides to manage cracking due to SCC. The reviewer first determines if the aging effect of cracking due to SCC is applicable and requires aging management. The aging effect of cracking is to be considered applicable unless it is demonstrated that one of the two acceptance criteria are met by demonstrating that an aggressive environment is not present or the specific material is not susceptible, as discussed in Section 3.3.2.2.10. Additionally, guidance is also provided on the review of the third condition necessary for SCC to occur, a sustained tensile stress. Each of three conditions is evaluated based on the review procedures below.

Susceptible Material: If the material of the component being evaluated is not susceptible to SCC then the aging effect of cracking due to SCC is not applicable and does not require aging management. When determining if an aluminum alloy is susceptible to SCC the reviewer is to verify the material's (a) alloy composition, (b) condition or temper, and (c) product form. Additionally, if the material was produced using a process specifically developed to provide a SCC resistant microstructure then the reviewer will consider the effects of this processing in the review. Once the material information has been established the reviewer is to evaluate the technical justification used to substantiate that the material is not susceptible to SCC when exposed to an aggressive environment and sustained tensile stress. The reviewer will evaluate all documentation and references used by the applicant as part of a technical justification.

Aggressive Environment: If the environment that an aluminum alloy is exposed to is not aggressive, such as dry gas, controlled indoor air, or treated water, then the aging effect of cracking due to SCC is not applicable and does not require aging management. The environments cited in the AMR line items in the GALL-SLR Report that reference this further evaluation are considered to be aggressive and potentially containing halide concentrations that facilitate SCC of aluminum alloys. The reviewer is to verify that components are not also periodically exposed to nontypical environments that would be categorized as aggressive, such as outdoor air which has recently been introduced into a building and the leakage/seepage of untreated aqueous solutions into a building or underground vault. Using information provided by the applicant, the reviewer will also evaluate the chemical composition of applicable encapsulating materials (e.g., concrete, insulation) for halides.

If a barrier coating is employed to effectively isolate the aluminum alloy from an aggressive environment then the aging effect of cracking due to SCC is not applicable and does not require aging management. The reviewer is to verify that the barrier coating is impermeable to the plant-specific aqueous solutions and atmospheric air that the coating is intended to protect the alloy from being exposed to. If operating experience is cited as a technical justification for the effectiveness of a barrier coating the reviewer is to verify that the applicant has a program to manage loss of coating integrity equivalent to GALL-SLR Report AMP XI.M42.

Sustained Tensile Stress: If the sustained tensile stress being experienced by a component is below the SCC threshold value then cracking will not occur and the aging effect is not applicable. Many aluminum alloys do not have a true SCC threshold stress, although a practical SCC threshold value can be determined based on the material, service environment, and duration of intended function. The basis for the SCC threshold value is to be evaluated to determine its applicability. The magnitude of the maximum tensile service stress (applied and residual) experienced by the component is to be evaluated to verify that the stress levels are bounded by the SCC threshold value.

The information necessary to eliminate the aging effect of SCC based on the sustained service stress is often not readily available. The SCC threshold stress level is dependent on both the alloy (e.g., chemical composition, processing history, and microstructure) and service environment. Furthermore, the magnitude and state of the residual stress sustained by a component is typically not fully characterized. The reviewer must determine the adequacy of both the SCC threshold value being used by the applicant and the magnitude of the tensile stress being experienced by the component. The evaluation of the SCC threshold value includes the verification that the (a) test method used to establish the threshold value is standardized and recognized by the industry, (b) data is statistically significant or conservative, and (c) data is for a relevant alloy, temper, product form, and environment. The evaluation of the tensile stress being experienced by the component includes the verification that the stress analysis accounts for (e) all applied and residual stresses and (f) stress raiser that can initiate SCC cracks, such as corrosion pits and fabrication defects.

Documentation that may assist the reviewer in determining if the aging effect of cracking due to SCC is applicable and requires aging management include (a) component drawings, (b) applicable Codes or specifications used in the design, fabrication, and installation of the component, (c) material-specific material certification data and lot release data, and (d) maintenance records and plant-specific operating experience.

If it is determined that the aging effect of cracking due to SCC is applicable the reviewer is to evaluate the applicants proposed AMP to ensure that the effects of aging on components are adequately managed so that their intended functions will be maintained consistent with the CLB for the subsequent period of extended operation. GALL-SLR Report AMP XI.M29, “Aboveground Metallic Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in tanks. GALL-SLR Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” is an acceptable method to manage cracking of aluminum due to SCC in piping and piping components. GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in piping and tanks which are buried or underground. GALL-SLR Report AMP XI.M27, “Fire Water System,” is an acceptable method to manage cracking of aluminum due to SCC in fire water storage tanks. GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components” is an acceptable method to manage cracking of aluminum due to SCC in components that are not included in other AMPs.

3.3.3.2.11 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking

The GALL-SLR Report recommends that for steel piping and piping components exposed to concrete, if the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to groundwater. For SS piping and piping components, loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice, or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," is an acceptable method to manage these aging effects.

The reviewer verifies that the concrete was specified to meet ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557. The reviewer should evaluate plant-specific operating experience to determine whether concrete degradation sufficient to allow water intrusion has occurred.

3.3.3.2.12 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

The GALL-SLR Report recommends that loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 ppb. In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

The reviewer verifies the applicant's chemistry control parameters to determine whether GALL-SLR Report AMP XI.M2, "Water Chemistry," and a one-time inspection program is implemented (e.g., GALL-SLR Report AMP XI.M32, "One-Time Inspection") or GALL-SLR Report AMP XI.M2, "Water Chemistry," and a periodic inspection program is implemented (e.g., GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components") to manage loss of material.

3.3.3.2.13 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

The GALL-SLR Report recommends a further evaluation to determine whether an AMP is needed to manage the aging effect of loss of material due to pitting and crevice corrosion of aluminum piping, piping components, and tanks exposed to an air environment. If the applicant claims that a search of 10 years of plant-specific did not reveal any instances of loss of material due to pitting and crevice corrosion exposed to air environments, the staff conducts an independent review of plant-specific operating experience during the AMP audit.

An alternative strategy to demonstrating that pitting and crevice corrosion is not applicable is to isolate the aluminum alloy from the air environment using a barrier. Acceptable barriers include anodization and tightly adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating an aluminum alloy from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impermeable to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," is an acceptable method to manage the integrity of internal and external barrier coatings.

The reviewer is to verify that the SLRA cites the use of GALL-SLR AMP XI.M32, "One-Time Inspection," for all aluminum piping, piping components, and tanks exposed to air environments. Alternatively, if the applicant states that it will utilize a strategy of isolating the aluminum components from the environment, verify that the aluminum components are coated and GALL-SLR AMP XI.M42 has been cited to manage loss of coating integrity.

3.3.3.3 Aging Management Review Results Not Consistent With or Not Addressed in the Generic Aging Lessons Learned for Subsequent License Renewal Report

The reviewer should confirm that the applicant, in its SLRA, has identified applicable aging effects, listed the appropriate combination of materials and environments, and has credited AMPs that will adequately manage the aging effects. The AMP credited by the applicant could be an AMP that is described and evaluated in the GALL-SLR Report or a plant-specific program. Review procedures are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

3.3.3.4 Aging Management Programs

The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL-SLR Report. If the applicant commits to an enhancement to make its SLRA AMP consistent with a GALL-SLR Report AMP, then the reviewer is to confirm that this enhancement, when implemented, will make the SLRA AMP consistent with the GALL-SLR Report AMP. If the applicant identifies, in the SLRA AMP, an exception to any of the program elements of the GALL-SLR Report AMP, the reviewer is to confirm that the SLRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3). If the reviewer identifies a difference, not identified by the SLRA, between the SLRA AMP and the GALL-SLR Report AMP with which the SLRA claims to be consistent, the reviewer should confirm that the SLRA AMP with this difference satisfies 10 CFR 54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions or differences. The AMPs evaluated in the GALL-SLR Report pertinent to the auxiliary systems components are summarized in Table 3.3-1 of this SRP-SLR. The "GALL-SLR Item" column identifies the AMR item numbers in the GALL-SLR Report, Chapter VII, presenting detailed information summarized by this row.

3.3.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of this section, then an evaluation finding similar to the following text should be included in the NRC staff's safety evaluation report:

On the basis of its review, as discussed above, the NRC staff concludes that the applicant has demonstrated that the aging effects associated with the auxiliary systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

The NRC staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).

3.3.5 Implementation

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

3.3.6 References

1. NRC. NUREG–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants." Washington, DC: U.S. Nuclear Regulatory Commission. March 2007.

2. NEI. NEI 95-10, "Industry Guideline for Implementing the Requirements of 1 0 CFR Part 54–The License Renewal Rule." Revision 6. Washington, DC: Nuclear Energy Institute.

3. ASME. Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components." ASME Boiler and Pressure Vessel Code, 2004 Edition. New York City, New York: The American Society of Mechanical Engineers.

4. ASTM International. "Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation." D95-83. West Conshohocken, Pennsylvania, American Society for Testing and Materials. 1990.

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	1	BWR/PWR	Steel cranes: structural girders exposed to air – indoor uncontrolled (external), air – outdoor	Cumulative fatigue damage due to fatigue	TLAA, SRP-SLR Section 4.7 "Other Plant-Specific TLAAs"	Yes (SRP-SLR Section 3.3.2.2.1)	VII.B.A-06
M	2	BWR/PWR	Stainless steel, steel heat exchanger components and tubes, piping, piping components exposed to treated borated water, air - indoor, uncontrolled, treated water	Cumulative fatigue damage due to fatigue	TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	Yes (SRP-SLR Section 3.3.2.2.1)	VII.E1.A-100 VII.E1.A-34 VII.E1.A-57 VII.E3.A-34 VII.E3.A-62 VII.E4.A-62
M	3	PWR	Stainless steel heat exchanger components, non-regenerative exposed to treated borated water >60°C (>140°F)	Cracking due to stress corrosion cracking; cyclic loading	AMP XI.M2, "Water Chemistry"	Yes (SRP-SLR Section 3.3.2.2.2)	VII.E1.A-69
M	4	BWR/PWR	Stainless steel piping, piping components exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.C1.AP-209 VII.C2.AP-209 VII.C3.AP-209 VII.D.AP-209 VII.E1.AP-209 VII.E4.AP-209 VII.F1.AP-209 VII.F2.AP-209 VII.F4.AP-209 VII.G.AP-209 VII.H1.AP-209 VII.H2.AP-209

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
D	5	-	-	-	-	-	-
M	6	BWR/PWR	Stainless steel piping, piping components exposed to air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.C1.AP-221 VII.C2.AP-221 VII.C3.AP-221 VII.D.AP-221 VII.E1.AP-221 VII.E4.AP-221 VII.F1.AP-221 VII.F2.AP-221 VII.F4.AP-221 VII.G.AP-221 VII.H1.AP-221 VII.H2.AP-221
-	7	PWR	Stainless steel high-pressure pump, casing exposed to treated borated water	Cracking due to cyclic loading	AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	VII.E1.AP-115
-	8	PWR	Stainless steel heat exchanger components and tubes exposed to treated borated water >60°C (>140°F)	Cracking due to cyclic loading	AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections	No	VII.E1.AP-119

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
					IWB, IWC, and IWD"		
M	9	PWR	Steel, aluminum, copper alloy (>15% Zn) external surfaces, piping, piping components, bolting exposed to air with borated water leakage	Loss of material due to boric acid corrosion	AMP XI.M10, "Boric Acid Corrosion"	No	VII.A3.A-79 VII.A3.AP-1 VII.E1.A-79 VII.E1.AP-1 VII.I.A-102 VII.I.A-79 VII.I.AP-66
	10	BWR/PWR	Steel, high-strength closure bolting exposed to air with steam or water leakage	Cracking due to stress corrosion cracking; cyclic loading	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-04
	11	BWR/PWR	Steel, high-strength high-pressure pump, closure bolting exposed to air with steam or water leakage	Cracking due to stress corrosion cracking; cyclic loading	AMP XI.M18, "Bolting Integrity"	No	VII.E1.AP-122
	12	BWR/PWR	Steel; stainless steel closure bolting, bolting exposed to condensation, air – indoor uncontrolled (external), air – outdoor (external)	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M18, "Bolting Integrity"	No	VII.D.AP-121 VII.I.AP-125 VII.I.AP-126
	13	BWR/PWR	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-03
M	14	BWR/PWR	Steel, stainless steel bolting exposed to soil	Loss of preload due to thermal effects, gasket creep, or self-loosening	AMP XI.M18, "Bolting Integrity"	No	VII.I.AP-242 VII.I.AP-244

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	15	BWR/PWR	Steel; stainless steel, copper alloy, nickel alloy, stainless steel closure bolting, bolting exposed to air – indoor uncontrolled (external), any environment, air – outdoor (external), raw water, waste water, treated borated water, fuel oil, treated water	Loss of preload due to thermal effects, gasket creep, or self-loosening	AMP XI.M18, "Bolting Integrity"	No	VII.I.AP-124 VII.I.AP-261 VII.I.AP-262 VII.I.AP-263 VII.I.AP-264 VII.I.AP-265 VII.I.AP-266 VII.I.AP-267
M	16	BWR	Stainless steel piping, piping components, outboard the second containment isolation valves with a diameter ≥4 inches nominal pipe size exposed to treated water > 93°C (> 200°F)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	AMP XI.M2, "Water Chemistry," and AMP XI.M25, "BWR Reactor Water Cleanup System"	No	VII.E3.AP-283
	17	BWR/PWR	Stainless steel heat exchanger tubes exposed to treated water, treated borated water	Reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-139 VII.A3.A-101 VII.E1.A-101
M	18	BWR/PWR	Stainless steel high-pressure pump, casing, piping, piping components, exposed to treated borated water >60°C (>140°F), sodium pentaborate solution >60°C (>140°F)	Cracking due to stress corrosion cracking	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E1.AP-114 VII.E2.AP-181
	19	BWR/PWR	Stainless steel regenerative heat exchanger components exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E3.AP-120

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	20	BWR/PWR	Stainless steel, steel with stainless steel cladding heat exchanger components exposed to treated borated water >60°C (>140°F), treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E1.AP-118 VII.E3.AP-112
M	21	BWR	Steel piping, piping components, exposed to treated water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E3.AP-106 VII.E4.AP-106
M	22	BWR	Copper alloy piping, piping components, exposed to treated water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-140 VII.E3.AP-140 VII.E4.AP-140
D	23	-	-	-	-	-	-
D	24	-	-	-	-	-	-
M	25	BWR	Aluminum piping exposed to treated water	Loss of material due to pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-130 VII.E3.AP-130 VII.E4.AP-130

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
	26	BWR/PWR	Steel with stainless steel cladding piping, piping components exposed to treated water	Loss of material due to pitting, crevice corrosion (only after cladding degradation)	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A4.AP-108
	27	BWR	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.E3.AP-139
M	28	PWR	Stainless steel piping, piping components, tanks exposed to treated borated water	Cracking due to stress corrosion cracking, MIC	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.12)	VII.E1.AP-82
M	29	PWR	Steel (with stainless steel cladding); stainless steel piping, piping components exposed to treated borated water	Loss of material due to pitting, crevice corrosion, MIC	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.12)	VII.E1.A-88
M	30	BWR/PWR	Concrete, cementitious material piping, piping components exposed to raw water	Changes in material properties due to aggressive chemical attack	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-250
M	30.2	BWR/PWR	Fiberglass, HDPE piping, piping components exposed to raw water (internal)	Cracking, blistering, change in color due to water absorption	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-238 VII.C1.AP-239
M	31	BWR/PWR	Concrete, cementitious material piping, piping components exposed to raw water	Cracking due to settling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-248

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	32	BWR/PWR	Reinforced concrete, asbestos cement piping, piping components exposed to raw water	Cracking due to aggressive chemical attack and leaching; changes in material properties due to aggressive chemical attack	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-155
M	32.5	BWR/PWR	Elastomer seals, piping, piping components exposed to raw water	Hardening and loss of strength due to elastomer degradation; loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.AP-75 VII.C1.AP-76 VII.G.AP-75 VII.G.AP-76
M	33	BWR/PWR	Concrete, cementitious material piping, piping components exposed to raw water	Loss of material due to abrasion, cavitation, aggressive chemical attack, leaching	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-249
M	34	BWR/PWR	Nickel alloy, copper alloy piping, piping components exposed to raw water	Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-206 VII.C3.AP-195 VII.C3.AP-206
M	35	BWR/PWR	Copper alloy piping, piping components exposed to raw water	Loss of material due to general, pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.H2.AP-193

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	36	BWR/PWR	Copper alloy piping, piping components exposed to raw water	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-196
M	37	BWR/PWR	Steel piping, piping components exposed to raw water	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-194 VII.C3.AP-194 VII.H2.AP-194
M	38	BWR/PWR	Copper alloy, steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.AP-179 VII.C1.AP-183
M	39	BWR/PWR	Stainless steel piping, piping components, exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C3.A-53
M	40	BWR/PWR	Stainless steel piping, piping components exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC; fouling that leads to corrosion;	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.A-54

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
				flow blockage due to fouling			
M	41	BWR/PWR	Stainless steel piping, piping components, exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC; flow blockage due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.H2.AP-55
	42	BWR/PWR	Copper alloy, titanium, stainless steel heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	AMP XI.M20, "Open-Cycle Cooling Water System"	No	VII.C1.A-72 VII.C1.AP-153 VII.C1.AP-187 VII.C3.AP-187 VII.G.AP-187 VII.H2.AP-187
M	43	BWR/PWR	Stainless steel piping, piping components, exposed to closed- cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-186 VII.E3.AP-186 VII.E4.AP-186
	44	BWR/PWR	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.E3.AP-192
M	45	BWR/PWR	Steel piping, piping components, tanks exposed to closed-cycle cooling water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-202 VII.F1.AP-202 VII.F2.AP-202 VII.F3.AP-202

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
							VII.F4.AP-202 VII.H2.AP-202
M	46	BWR/PWR	Steel, copper alloy heat exchanger components, piping, piping components exposed to closed- cycle cooling water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.A3.AP-189 VII.A3.AP-199 VII.A4.AP-189 VII.A4.AP-199 VII.C2.AP-189 VII.C2.AP-199 VII.E1.AP-189 VII.E1.AP-199 VII.E1.AP-203 VII.E3.AP-189 VII.E3.AP-199 VII.E4.AP-189 VII.E4.AP-199 VII.F1.AP-189 VII.F1.AP-199 VII.F1.AP-203 VII.F2.AP-189 VII.F2.AP-199

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
							VII.F3.AP-189 VII.F3.AP-199 VII.F3.AP-203 VII.F4.AP-189 VII.F4.AP-199 VII.H1.AP-199 VII.H2.AP-199
M	47	BWR	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.E3.AP-191 VII.E4.AP-191
M	48	BWR/PWR	Aluminum piping, piping components exposed to closed-cycle cooling water	Loss of material due to pitting, crevice corrosion	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-254 VII.H2.AP-255
M	49	BWR/PWR	Stainless steel piping, piping components, exposed to closed-cycle cooling water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.A-52
	50	BWR/PWR	Stainless steel, copper alloy, steel heat exchanger tubes exposed to closed-cycle cooling water	Reduction of heat transfer due to fouling	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.AP-188 VII.C2.AP-205 VII.E3.AP-188 VII.E4.AP-188 VII.F1.AP-204 VII.F1.AP-205 VII.F2.AP-204 VII.F2.AP-205 VII.F3.AP-204

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
							VII.F3.AP-205 VII.F4.AP-204
	51	BWR/PWR	Boraflex spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water	Reduction of neutron-absorbing capacity due to boraflex degradation	AMP XI.M22, "Boraflex Monitoring"	No	VII.A2.A-86 VII.A2.A-87
M	52	BWR/PWR	Steel cranes: rails and structural girders exposed to air – indoor uncontrolled, air – outdoor	Loss of material due to general corrosion	AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	VII.B.A-07
M	53	BWR/PWR	Steel cranes - rails exposed to air – indoor uncontrolled, air – outdoor	Loss of material due to wear	AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	VII.B.A-05
M	54	BWR/PWR	Copper alloy piping, piping components, exposed to condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M24, "Compressed Air Monitoring"	No	VII.D.AP-240

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	55	BWR/PWR	Steel piping, piping components exposed to condensation (internal)	Loss of material due to general, pitting corrosion	AMP XI.M24, "Compressed Air Monitoring"	No	VII.D.A-26
M	56	BWR/PWR	Stainless steel piping, piping components, exposed to condensation (internal)	Loss of material due to pitting, crevice corrosion	AMP XI.M24, "Compressed Air Monitoring"	No	VII.D.AP-81
	57	BWR/PWR	Elastomer fire barrier penetration seals exposed to air – indoor uncontrolled, air – outdoor	Increased hardness; shrinkage; loss of strength due to weathering	AMP XI.M26, "Fire Protection"	No	VII.G.A-19 VII.G.A-20
M	58	BWR/PWR	Steel halon/carbon dioxide fire suppression system piping, piping components exposed to air – indoor uncontrolled (external)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M26, "Fire Protection"	No	VII.G.AP-150
	59	BWR/PWR	Steel fire rated doors exposed to air – indoor uncontrolled, air – outdoor	Loss of material due to wear	AMP XI.M26, "Fire Protection"	No	VII.G.A-21 VII.G.A-22
	60	BWR/PWR	Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air – indoor uncontrolled	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	AMP XI.M26, "Fire Protection," and AMP XI.S6, "Structures Monitoring"	No	VII.G.A-90
	61	BWR/PWR	Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air – outdoor	Cracking, loss of material due to freeze- thaw, aggressive chemical attack, and reaction with aggregates	AMP XI.M26, "Fire Protection," and AMP XI.S6, "Structures Monitoring"	No	VII.G.A-92

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
	62	BWR/PWR	Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air - indoor, uncontrolled, air – outdoor	Loss of material due to corrosion of embedded steel	AMP XI.M26, "Fire Protection," and AMP XI.S6, "Structures Monitoring"	No	VII.G.A-91 VII.G.A-93
	63	BWR/PWR	Steel fire hydrants exposed to air – outdoor	Loss of material due to general, pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No	VII.G.AP-149
M	64	BWR/PWR	Steel, copper alloy piping, piping components exposed to raw water	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No	VII.G.A-33 VII.G.AP-197
M	65	BWR/PWR	Aluminum piping, piping components exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No	VII.G.AP-180
M	66	BWR/PWR	Stainless steel piping, piping components exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No	VII.G.A-55

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
M	67	BWR/PWR	Steel tanks exposed to air – outdoor (external)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	No	VII.H1.A-95
M	68	BWR/PWR	Steel piping, piping components exposed to fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.G.AP-234
M	69	BWR/PWR	Copper alloy piping, piping components exposed to fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.G.AP-132 VII.H1.AP-132 VII.H2.AP-132
M	70	BWR/PWR	Steel piping, piping components, tanks exposed to fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.H1.AP-105 VII.H2.AP-105
M	71	BWR/PWR	Stainless steel, aluminum piping, piping components exposed to fuel oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M30, "Fuel Oil Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.G.AP-136 VII.H1.AP-129 VII.H1.AP-136 VII.H2.AP-129 VII.H2.AP-136
M	72	BWR/PWR	Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components, heat exchanger components	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No	VII.A3.AP-31 VII.A3.AP-43 VII.A4.AP-31 VII.A4.AP-32

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
			exposed to treated water, closed-cycle cooling water, soil, raw water, waste water, ground water				VII.A4.AP-43 VII.C1.A-02 VII.C1.A-47 VII.C1.A-51 VII.C1.A-66 VII.C2.A-50 VII.C2.AP-31 VII.C2.AP-32 VII.C2.AP-43 VII.C3.A-02 VII.C3.A-47 VII.C3.A-51 VII.E1.AP-31 VII.E1.AP-43 VII.E1.AP-65 VII.E3.AP-31 VII.E3.AP-32 VII.E3.AP-43 VII.E4.AP-31 VII.E4.AP-32 VII.E4.AP-43 VII.E5.A-547 VII.E5.A-724 VII.F1.AP-31 VII.F1.AP-43 VII.F1.AP-65 VII.F2.AP-31 VII.F2.AP-43 VII.F3.A-50 VII.F3.AP-43 VII.F3.AP-65 VII.F4.AP-31 VII.F4.AP-43 VII.G.A-02 VII.G.A-47

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							VII.G.A-51 VII.G.AP-31 VII.H1.A-02 VII.H1.AP-43 VII.H2.A-02 VII.H2.A-47 VII.H2.A-51 VII.H2.AP-43
M	73	BWR/PWR	Concrete, cementitious material piping, piping components exposed to air – outdoor	Changes in material properties due to aggressive chemical attack	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.C1.AP-253
M	74	BWR/PWR	Concrete, cementitious material piping, piping components exposed to air – outdoor	Cracking due to settling	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.C1.AP-251
M	75	BWR/PWR	Reinforced concrete, asbestos cement piping, piping components exposed to air – outdoor	Cracking due to aggressive chemical attack and leaching; changes in material properties due to aggressive chemical attack	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.C1.AP-156
M	76	BWR/PWR	Elastomer seals, piping, piping components exposed to air – indoor uncontrolled (internal/external), air – indoor controlled, outdoor air, dry air, condensation, air with borated water leakage	Hardening and loss of strength due to elastomer degradation	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.F1.AP-102 VII.F2.AP-102 VII.F3.AP-102 VII.F4.AP-102

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	77	BWR/PWR	Concrete, cementitious material piping, piping components exposed to air – outdoor	Loss of material due to abrasion, cavitation, aggressive chemical attack, leaching	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.C1.AP-252
M	78	BWR/PWR	Steel piping and components, ducting, closure bolting exposed to air – indoor uncontrolled, air – outdoor, condensation	Loss of material due to general, pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.D.A-80 VII.F1.A-10 VII.F1.A-105 VII.F2.A-10 VII.F2.A-105 VII.F3.A-10 VII.F3.A-105 VII.F4.A-10 VII.F4.A-105 VII.I.A-105 VII.I.A-77 VII.I.A-78 VII.I.A-81
M	79	BWR/PWR	Copper alloy piping, piping components, exposed to condensation (external)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.AP-109
M	80	BWR/PWR	Steel heat exchanger components, piping, piping components, exposed to air – indoor uncontrolled (external), air – outdoor (external)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.F1.AP-41 VII.F2.AP-41 VII.F3.AP-41 VII.F4.AP-41 VII.G.AP-40 VII.G.AP-41 VII.H1.A-24 VII.H2.AP-40 VII.H2.AP-41

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	81	BWR/PWR	Copper alloy, aluminum piping, piping components, exposed to air – outdoor (external), air – outdoor	Loss of material due to general (copper alloy only) pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.AP-159 VII.I.AP-256
M	82	BWR/PWR	Elastomer seals and components exposed to air – indoor uncontrolled (external), air – indoor controlled, outdoor air, dry air, air with borated water leakage	Loss of material due to wear	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.AP-113
M	83	BWR/PWR	Stainless steel diesel engine exhaust piping, piping components exposed to diesel exhaust	Cracking due to stress corrosion cracking	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.H2.AP-128
M	85	BWR/PWR	Elastomer seals, piping, piping components exposed to closed-cycle cooling water	Hardening and loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C2.AP-259
M	86	BWR/PWR	Elastomer seals piping and piping components exposed to treated borated water, treated water	Hardening and loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and	No	VII.A3.AP-100 VII.A4.AP-101

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
					Ducting Components"		
M	88	BWR/PWR	Steel; stainless steel piping and piping components, diesel engine exhaust exposed to raw water (potable), diesel exhaust	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-270 VII.H2.AP-104
M	89	BWR/PWR	Steel, copper alloy piping, piping components exposed to moist air, condensation (internal)	Loss of material due to general, pitting, crevice corrosion	For fire water system components: AMP XI.M27, "Fire Water System"	No	VII.G.AP-143
-	90	BWR/PWR	Steel ducting and components (internal surfaces) exposed to condensation (internal)	Loss of material due to general, pitting, crevice corrosion, (for drip pans and drain lines) MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.F1.A-08 VII.F2.A-08 VII.F3.A-08 VII.F4.A-08
M	91	BWR/PWR	Steel piping, piping components, tanks exposed to waste water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-281

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	92	BWR/PWR	Aluminum piping, piping components, exposed to condensation (internal)	Loss of material due to pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.F1.AP-142 VII.F2.AP-142 VII.F3.AP-142 VII.F4.AP-142
M	93	BWR/PWR	Copper alloy piping, piping components, exposed to raw water (potable)	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-271
	94	BWR/PWR	Stainless steel ducting and components exposed to condensation	Loss of material due to pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.F1.AP-99 VII.F2.AP-99 VII.F3.AP-99
M	95	BWR/PWR	Copper alloy, stainless steel, aluminum, nickel alloy, steel piping, piping components, heat exchanger components, piping, piping components, tanks exposed to waste water, condensation (internal)	Loss of material due to general (steel and copper alloy only), pitting, crevice corrosion, MIC (steel, stainless steel, nickel alloy, and copper alloy in waste water environments only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.AP-272 VII.E5.AP-273 VII.E5.AP-274 VII.E5.AP-275 VII.E5.AP-276 VII.E5.AP-

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
							278 VII.E5.AP-279 VII.E5.AP-280
M	96	BWR/PWR	Elastomer seals, piping, piping components exposed to air – indoor uncontrolled (internal)	Loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.F1.AP-103 VII.F2.AP-103 VII.F3.AP-103 VII.F4.AP-103
N	96.2	BWR/PWR	Steel, aluminum, copper alloy, stainless steel heat exchanger tubes exposed to condensation (for components not covered by NRC GL 89-13)	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-419 VII.F1.A-419 VII.F2.A-419 VII.F3.A-419 VII.F4.A-419
N	96.4	BWR/PWR	Steel, aluminum, copper alloy, stainless steel heat exchanger components exposed to condensation (for components not covered by NRC GL 89-13)	Loss of material due to general (steel and copper alloy only), pitting, crevice corrosion; fouling that leads to corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-417 VII.C1.A-418 VII.F1.A-417 VII.F1.A-418 VII.F2.A-417 VII.F2.A-418 VII.F3.A-417 VII.F3.A-418 VII.F4.A-417 VII.F4.A-418
M	97	BWR/PWR	Steel piping, piping components, reactor coolant pump oil collection system: tanks, reactor coolant pump	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32,	No	VII.C1.AP-127 VII.C2.AP-127

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
			oil collection system: piping, tubing, valve bodies exposed to lubricating oil		"One-Time Inspection"		VII.E1.AP-127 VII.E4.AP-127 VII.F1.AP-127 VII.F2.AP-127 VII.F3.AP-127 VII.F4.AP-127 VII.G.AP-116 VII.G.AP-117 VII.G.AP-127 VII.H2.AP-127
-	98	BWR/PWR	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.H2.AP-131
M	99	BWR/PWR	Copper alloy, aluminum piping, piping components exposed to lubricating oil	Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC (copper alloy only)	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.C1.AP-133 VII.C2.AP-133 VII.E1.AP-133 VII.E4.AP-133 VII.G.AP-133 VII.H2.AP-133 VII.H2.AP-162

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	100	BWR/PWR	Stainless steel piping, piping components exposed to lubricating oil	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.C1.AP-138 VII.C2.AP-138 VII.E1.AP-138 VII.E4.AP-138 VII.G.AP-138 VII.H2.AP-138
-	101	BWR/PWR	Aluminum heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	No	VII.H2.AP-154
-	102	BWR/PWR	Boral®; boron steel, and other materials (excluding Boraflex) spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water	Reduction of neutron-absorbing capacity; change in dimensions and loss of material due to effects of SFP environment	AMP XI.M40, "Monitoring of Neutron-Absorbing Materials other than Boraflex"	No	VII.A2.AP-235 VII.A2.AP-236
M	103	BWR/PWR	Reinforced concrete, asbestos cement piping, piping components exposed to soil, concrete	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.AP-157

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	104	BWR/PWR	HDPE, fiberglass piping, piping components exposed to soil, concrete	Cracking, blistering, change in color due to water absorption	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.AP-175 VII.C1.AP-176
M	105	BWR/PWR	Concrete, concrete cylinder piping, asbestos cement pipe piping, piping components exposed to soil, concrete	Cracking, spalling, corrosion of rebar due to exposure of rebar	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.AP-177 VII.C1.AP-178 VII.C1.AP-237
M	106	BWR/PWR	Steel (with coating or wrapping) piping, piping components exposed to soil, concrete	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.AP-198 VII.C3.AP-198 VII.G.AP-198 VII.H1.AP-198
M	107	BWR/PWR	Stainless steel, nickel alloy piping, piping components exposed to soil, concrete	Loss of material due to pitting, crevice corrosion, MIC (soil environment only)	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.AP-137 VII.C3.AP-137 VII.G.AP-137 VII.H1.AP-137 VII.H2.AP-137
M	108	BWR/PWR	Titanium, super austenitic, aluminum, copper alloy, stainless steel, nickel alloy piping, piping components, bolting exposed to soil, concrete	Loss of material due to pitting, crevice corrosion, MIC (soil environment only)	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.AP-171 VII.C1.AP-172 VII.C1.AP-173 VII.C1.AP-

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
							174 VII.I.AP-243
M	109	BWR/PWR	Steel bolting exposed to soil, concrete	Loss of material due to general, pitting, crevice corrosion, MIC (soil environment only)	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-241
M	109a	BWR/PWR	Copper alloy, stainless steel, nickel alloy, steel underground piping, piping components exposed to air – indoor uncontrolled, condensation, air – outdoor (external)	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.AP-284
M	110	BWR	Stainless steel piping, piping components exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	AMP XI.M7, "BWR Stress Corrosion Cracking," and AMP XI.M2, "Water Chemistry"	Yes (SRP-SLR Section 3.3.2.2.9)	VII.E4.A-61
	111	BWR/PWR	Steel structural steel exposed to air – indoor uncontrolled (external)	Loss of material due to general, pitting, crevice corrosion	AMP XI.S6, "Structures Monitoring"	No	VII.A1.A-94
M	112	BWR/PWR	Steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.3.2.2.11)	VII.J.AP-282
M	113	BWR/PWR	Aluminum piping, piping components exposed to gas	None	None	No	VII.J.AP-37

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	114	BWR/PWR	Copper alloy piping, piping components exposed to air – indoor uncontrolled (internal/external), air – dry, gas	None	None	No	VII.J.AP-144 VII.J.AP-8 VII.J.AP-9
M	115	PWR	Copper alloy piping, piping components exposed to air with borated water leakage	None	None	No	VII.J.AP-11
M	116	BWR/PWR	Galvanized steel piping, piping components exposed to air – indoor uncontrolled	None	None	No	VII.J.AP-13
M	117	BWR/PWR	Glass piping elements exposed to air, air – indoor uncontrolled (external), lubricating oil, closed-cycle cooling water, air – outdoor, fuel oil, raw water, treated water, treated borated water, air with borated water leakage, condensation (internal/external), gas	None	None	No	VII.J.AP-14 VII.J.AP-15 VII.J.AP-166 VII.J.AP-167 VII.J.AP-48 VII.J.AP-49 VII.J.AP-50 VII.J.AP-51 VII.J.AP-52 VII.J.AP-96 VII.J.AP-97 VII.J.AP-98
M	118	BWR/PWR	Nickel alloy piping, piping components exposed to air – indoor uncontrolled (external)	None	None	No	VII.J.AP-16
M	119	BWR/PWR	Nickel alloy, PVC, glass piping, piping components exposed to air with borated water leakage, air – indoor uncontrolled, condensation	None	None	No	VII.J.AP-260 VII.J.AP-268 VII.J.AP-269 VII.J.AP-277

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
			(internal), waste water, potable water, raw water				
M	120	BWR/PWR	Stainless steel piping, piping components exposed to air – indoor uncontrolled (internal/external), air – indoor uncontrolled (external), air with borated water leakage, air – dry, gas	None	None	No	VII.J.AP-123 VII.J.AP-17 VII.J.AP-18 VII.J.AP-20 VII.J.AP-22
M	121	BWR/PWR	Steel piping, piping components, exposed to air – indoor controlled (external), air – dry, gas	None	None	No	VII.J.AP-2 VII.J.AP-4 VII.J.AP-6
M	122	BWR/PWR	Titanium heat exchanger components, piping and piping components exposed to air – indoor uncontrolled, air – outdoor	None	None	No	VII.J.AP-151 VII.J.AP-160
M	123	BWR/PWR	Titanium (ASTM Grades 1,2, 7, 11, or 12) heat exchanger components other than tubes, piping and piping components exposed to raw water	None	None	No	VII.C1.AP-152 VII.C1.AP-161
M	124	BWR/PWR	Stainless steel, steel (with stainless steel or nickel-alloy cladding) spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components exposed to treated water >60°C (>140°F), treated borated water >60°C (>140°F)	Cracking due to stress corrosion cracking	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.A2.A-96 VII.A2.A-97 VII.A3.A-56 VII.E1.A-103

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	125	BWR/PWR	Steel (with stainless steel cladding); stainless steel spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components exposed to treated water, treated borated water	Loss of material due to pitting, crevice corrosion, MIC	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.12)	VII.A2.AP-79 VII.A3.AP-79 VII.E1.AP-79 VII.A2.A-98 VII.A2.A-99
M	126	BWR/PWR	Any material piping, piping components exposed to treated water, treated borated water, raw water	Wall thinning due to erosion	AMP XI.M17, "Flow-Accelerated Corrosion"	No	VII.C1.A-409 VII.E1.A-407 VII.E3.A-408
M	127	BWR/PWR	Metallic piping, piping components, tanks exposed to raw water, waste water	Loss of material due to recurring internal corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.7)	VII.A2.A-400 VII.A3.A-400 VII.A4.A-400 VII.C1.A-400 VII.C2.A-400 VII.C3.A-400 VII.D.A-400 VII.E1.A-400 VII.E2.A-400 VII.E3.A-400 VII.E4.A-400 VII.E5.A-400 VII.F1.A-400 VII.F2.A-400 VII.F3.A-400 VII.F4.A-400 VII.G.A-400 VII.H1.A-400 VII.H2.A-400
M	128	BWR/PWR	Steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil,	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M29, "Aboveground Metallic Tanks"	No	VII.C3.A-401 VII.E5.A-401 VII.H1.A-401

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
			concrete, air – outdoor, air – indoor uncontrolled, moist air, raw water, condensation	(soil, raw water environments only)			
M	129	BWR/PWR	Steel tanks exposed to soil, concrete; air – indoor uncontrolled, raw water, treated water, waste water, condensation	Loss of material due to general, pitting, crevice corrosion, MIC (soil, raw water, treated water, waste water environments only)	AMP XI.M29, "Aboveground Metallic Tanks"	No	VII.H1.A-402
M	130	BWR/PWR	Metallic sprinklers exposed to air – indoor controlled, air – indoor uncontrolled, air – outdoor, moist air, condensation, raw water, treated water	Loss of material due to general, pitting, crevice corrosion, MIC (raw water and treated water environments only and all metals except for aluminum only), fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No	VII.G.A-403
M	131	BWR/PWR	Steel, stainless steel, copper alloy, aluminum piping, piping components exposed to air – indoor uncontrolled (internal), air – outdoor (internal), condensation (internal)	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion, fouling that leads to corrosion; flow blockage due to fouling	AMP XI.M27, "Fire Water System"	No	VII.G.A-404

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
M	132	BWR/PWR	Insulated steel, copper alloy, copper alloy (> 15% Zn), aluminum piping, piping components, tanks exposed to condensation, air – outdoor	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion; cracking due to stress corrosion cracking (copper alloy (>15% Zn) only)	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-405
M	133	BWR/PWR	HDPE underground piping, piping components exposed to air – indoor uncontrolled, condensation, air – outdoor (external)	Cracking, blistering, change in color due to water absorption	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.A-406
M	134	BWR/PWR	Steel, stainless steel, copper alloy piping, piping components, and heat exchanger components exposed to a raw water environment (for components not covered by NRC GL 89-13)	Loss of material due to general (steel and copper alloy only), pitting, crevice corrosion, MIC, fouling that leads to corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-727
	135	BWR/PWR	Steel, stainless steel pump casings submerged in a waste water (internal and external) environment	Loss of material due to general (steel only), pitting, crevice corrosion, MIC	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.E5.A-410 VII.E5.A-411
M	136	BWR/PWR	Steel fire water storage tanks exposed to air – indoor uncontrolled, air – outdoor, condensation, moist air, raw water, treated water, soil, concrete	Loss of material due to general, pitting, crevice corrosion, MIC (raw water, treated water, soil only),	AMP XI.M27, "Fire Water System"	No	VII.G.A-412

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
				fouling that leads to corrosion			
M	137	BWR/PWR	Steel, stainless steel, aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to treated water, treated borated water	Loss of material due to general (steel only), pitting, crevice corrosion, MIC	AMP XI.M29, "Aboveground Metallic Tanks"	No	VII.C3.A-413 VII.E5.A-413 VII.H1.A-413
M	138	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil, fuel oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.A2.A-416 VII.A3.A-416 VII.A4.A-416 VII.C1.A-416 VII.C2.A-416 VII.C3.A-416 VII.D.A-416 VII.E1.A-416 VII.E2.A-416 VII.E3.A-416 VII.E4.A-416 VII.E5.A-416 VII.F1.A-416 VII.F2.A-416 VII.F3.A-416 VII.F4.A-416 VII.G.A-416 VII.H1.A-416 VII.H2.A-416
M	139	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water,	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion;	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components,	No	VII.A2.A-414 VII.A3.A-414 VII.A4.A-414 VII.C1.A-414 VII.C2.A-414 VII.C3.A-414

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
			treated water, treated borated water, lubricating oil, waste water	cracking due to stress corrosion cracking	Heat Exchangers, and Tanks"		VII.D.A-414 VII.E1.A-414 VII.E2.A-414 VII.E3.A-414 VII.E4.A-414 VII.E5.A-414 VII.F1.A-414 VII.F2.A-414 VII.F3.A-414 VII.F4.A-414 VII.G.A-414 VII.H1.A-414 VII.H2.A-414
M	140	BWR/PWR	Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, waste water	Loss of material due to selective leaching	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VII.C1.A-415 VII.C2.A-415 VII.C3.A-415 VII.D.A-415 VII.E1.A-415 VII.E2.A-415 VII.E3.A-415 VII.E4.A-415 VII.E5.A-415 VII.F1.A-415 VII.F2.A-415 VII.F3.A-415 VII.F4.A-415 VII.G.A-415 VII.H1.A-415 VII.H2.A-415
N	141	BWR/PWR	Steel, stainless steel bolting exposed to condensation, fuel oil, lubricating oil	Loss of preload due to thermal effects, gasket creep, or self-loosening	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-421 VII.I.A-422

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	142	BWR/PWR	Copper alloy bolting exposed to raw water, waste water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-423
N	143	BWR/PWR	Steel bolting exposed to lubricating oil, fuel oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-424
N	144	BWR/PWR	Stainless steel, aluminum piping, piping components exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.A-425 VII.C3.A-425 VII.E5.A-425 VII.G.A-425 VII.H1.A-425 VII.H2.A-425
N	145	BWR/PWR	Stainless steel bolting exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.A-426 VII.C3.A-426 VII.E5.A-426 VII.G.A-426 VII.H1.A-426 VII.H2.A-426
N	146	BWR/PWR	Stainless steel underground piping, piping components, tanks exposed to air – outdoor, raw water, condensation	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.C1.A-714 VII.C2.A-714 VII.C3.A-714 VII.D.A-714 VII.E1.A-714 VII.E4.A-714 VII.F1.A-714 VII.F2.A-714 VII.F4.A-714 VII.G.A-714 VII.H1.A-714 VII.H2.A-714

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	147	BWR/PWR	Nickel alloy and nickel alloy cladding piping, piping components exposed to closed cycle cooling water, closed cycle cooling water >60°C (>140°F)	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.A-471
N	148	BWR/PWR	Elastomer piping, ducting components exposed to air – outdoor	Hardening and loss of strength due to elastomer degradation	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-427
N	149	BWR/PWR	Fiberglass piping and ducting, piping and ducting components exposed to air – outdoor	Cracking, blistering, change in color due to water absorption	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-428
N	150	BWR/PWR	Fiberglass piping and ducting, piping and ducting components exposed to air – indoor	Change in material properties due to exposure to ultraviolet light, ozone, radiation, temperature	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-720
N	151	BWR/PWR	Stainless steel, steel, aluminum, copper alloy, titanium heat exchanger components exposed to air, condensation (external)	Reduction of heat transfer due to fouling	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-716
N	153	BWR/PWR	Elastomer seals, piping, piping components exposed to air – outdoor	Hardening and loss of strength due to elastomer degradation	AMP XI.M36, "External Surfaces Monitoring of	No	VII.I.A-708

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
					Mechanical Components"		
N	154	BWR/PWR	Elastomer, fiberglass piping, piping components, ducting, ducting components exposed to air-outdoor, air-indoor	Loss of material due to wear	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-719
N	155	BWR/PWR	Stainless steel piping, piping components, and tanks exposed to waste water greater than 140° F	Cracking due to stress corrosion cracking	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E5.A-721
N	156	BWR/PWR	Elastomer seals, piping, piping components exposed to condensation, waste water, gas, fuel oil, lubricating oil	Hardening and loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E1.A-504 VII.E2.A-504 VII.E3.A-504 VII.E4.A-504 VII.E5.A-504 VII.F1.A-504 VII.F2.A-504 VII.F3.A-504 VII.F4.A-504 VII.G.A-504 VII.H1.A-660 VII.H2.A-677 VII.E5.A-728 VII.D.A-729

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	157	BWR/PWR	Steel piping, piping components, heat exchanger components exposed to air-outdoor (internal)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.E1.A-722 VII.E2.A-722 VII.E3.A-722 VII.E4.A-722 VII.E5.A-722 VII.F1.A-722 VII.F2.A-722 VII.F3.A-722 VII.F4.A-722 VII.G.A-722 VII.H1.A-722 VII.H2.A-722
N	158	BWR/PWR	Nickel alloy piping, piping components heat exchanger components (for components not covered by NRC GL 89-13) exposed to raw water	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-454 VII.C2.A-454
N	159	BWR/PWR	Fiberglass piping, piping components, ducting and components exposed to air – indoor (internal)	Loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.D.A-495 VII.E5.A-495 VII.F1.A-495 VII.F2.A-495 VII.F3.A-495 VII.F4.A-495 VII.G.A-495 VII.H1.A-495 VII.H2.A-495
N	160	BWR/PWR	Copper alloy (>15% Zn or >8% Al) piping, piping components, heat exchanger components exposed to closed-cycle cooling water	Cracking due to stress corrosion cracking	AMP XI.M21A, "Closed Treated Water Systems"	No	VII.C2.A-473

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	161	BWR/PWR	Copper alloy heat exchanger components exposed to condensation	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.F1.A-565 VII.F2.A-565 VII.F3.A-565 VII.F4.A-565 VII.G.A-565 VII.H1.A-565 VII.H2.A-565
N	162	BWR/PWR	Steel, stainless steel, copper alloy piping, piping components exposed to air-outdoor	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No	VII.G.A-637
N	164	BWR/PWR	Gray cast iron piping, piping components exposed to air – indoor uncontrolled, air – outdoor, moist air, condensation, raw water, treated water, waste water (external)	Loss of material due to general, pitting, crevice corrosion, MIC (raw water, waste water, and treated water environments only)	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-455
N	165	BWR/PWR	Gray cast iron piping, piping components exposed to air – indoor uncontrolled, air – outdoor, moist air, condensation, raw water, treated water, waste water (internal)	Loss of material due to general, pitting, crevice corrosion, MIC (raw water, waste water, and treated water environments only)	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-456 VII.C2.A-456 VII.C3.A-456 VII.D.A-456 VII.E5.A-456 VII.G.A-456 VII.H1.A-456 VII.H2.A-456
N	166	BWR/PWR	Copper alloy piping, piping components exposed to concrete	None	None	No	VII.J.A-711

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	167	BWR/PWR	Zinc piping components exposed to air-indoor	None	None	No	VII.J.A-712
N	169	BWR/PWR	Steel, copper alloy piping, piping components exposed to steam	Loss of material due to general, pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.F1.A-566 VII.F2.A-566 VII.F3.A-566 VII.F4.A-566
N	170	BWR/PWR	Stainless steel piping, piping components exposed to steam	Loss of material due to pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.F1.A-567 VII.F2.A-567 VII.F3.A-567 VII.F4.A-567
N	171	BWR/PWR	Steel, stainless steel bolting exposed to raw water, waste water, treated water, treated borated water	Loss of material due to general (steel only), pitting, crevice corrosion	AMP XI.M18, "Bolting Integrity"	No	VII.I.A-725 VII.I.A-723 VII.I.A-726
N	172	BWR/PWR	PVC piping, piping components exposed to sunlight	Reduction in impact strength due to photolysis	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.8)	VII.C1.A-458 VII.E5.A-458 VII.G.A-458
N	173	BWR/PWR	Elastomer seals, piping, piping components exposed to raw water, raw water (for components not covered by NRC GL 89-13), waste water, treated water, fuel oil, lubricating oil, condensation	Hardening and loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-457 VII.C2.A-477 VII.D.A-498 VII.E5.A-548 VII.G.A-641 VII.H1.A-667 VII.H2.A-667 VII.A2.A-749 VII.A3.A-749 VII.A4.A-749 VII.C1.A-749

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
							VII.C2.A-749 VII.C3.A-749 VII.D.A-749 VII.E1.A-749 VII.E2.A-749 VII.E3.A-749 VII.E4.A-749 VII.E5.A-749 VII.F1.A-749 VII.F2.A-749 VII.F3.A-749 VII.F4.A-749 VII.G.A-749 VII.H1.A-749 VII.H2.A-749
N	174	BWR/PWR	Elastomer seals, piping, piping components exposed to raw water, raw water (for components not covered by NRC GL 89-13), waste water	Loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-459 VII.E5.A-550
N	175	BWR/PWR	Fiberglass piping, piping components, tanks exposed to raw water, raw water (for components not covered by NRC GL 89-13), waste water	Cracking, blistering, change in color due to water absorption	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-460 VII.E5.A-551 VII.G.A-644
N	176	BWR/PWR	Fiberglass piping, piping components, tanks exposed to raw water, raw water environment (for components	Loss of material due to wear	AMP XI.M38, "Inspection of Internal Surfaces in	No	VII.C1.A-461 VII.E5.A-552 VII.G.A-645

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
			not covered by NRC GL 89-13), waste water		Miscellaneous Piping and Ducting Components"		
N	177	BWR/PWR	Fiberglass piping, piping components exposed to soil	Loss of material due to wear	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.C1.A-462 VII.E5.A-462 VII.G.A-462
N	178	BWR/PWR	Fiberglass piping and piping components exposed to concrete	None	None	No	VII.J.A-710
N	179	BWR/PWR	Masonry walls: structural fire barriers exposed to air – indoor uncontrolled, air – outdoor	Cracking due to restraint shrinkage, creep, aggressive environment	AMP XI.M26, "Fire Protection," and AMP XI.S5, "Masonry Walls"	No	VII.G.A-626
N	180	BWR/PWR	Masonry walls: structural fire barriers exposed to air – outdoor	Loss of material (spalling, scaling) and cracking due to freeze-thaw	AMP XI.M26, "Fire Protection," and AMP XI.S5, "Masonry Walls"	No	VII.G.A-627
N	181	BWR/PWR	Stainless steel, nickel alloy, aluminum, titanium piping, piping components, exposed to condensation (External)	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-700 VII.I.A-701 VII.I.A-702 VII.I.A-703
N	182	BWR/PWR	Jacketed thermal insulation in an air – indoor uncontrolled, air – outdoor environment, air with borated water leakage, air with reactor coolant	Reduced thermal insulation resistance due to moisture intrusion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.I.A-704

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
			leakage, air with steam or water leakage				
N	184	BWR/PWR	PVC piping, piping components, tanks exposed to concrete	None	None	No	VII.J.A-709
N	185	BWR/PWR	Aluminum fire water storage tanks exposed to air – outdoor, raw water, condensation, soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M27, "Fire Water System"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.G.A-623
N	186	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air – outdoor, air – indoor controlled, air – indoor uncontrolled, raw water, waste water, condensation, soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.C3.A-482 VII.E5.A-482 VII.H1.A-482
N	187	BWR/PWR	Insulated aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air – outdoor, air – indoor controlled, air – indoor uncontrolled, condensation	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.G.A-654 VII.H1.A-654
N	189	BWR/PWR	Aluminum tanks, piping, piping components exposed to air – outdoor, raw water, waste water, condensation (internal)	Cracking due to stress corrosion cracking	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and	Yes (SRP-SLR Section 3.3.2.2.10)	VII.A2.A-429 VII.A3.A-429 VII.A4.A-429 VII.C1.A-451 VII.C2.A-451 VII.C3.A-451 VII.D.A-451

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
					Ducting Components"		VII.E1.A-451 VII.E2.A-451 VII.E3.A-451 VII.E4.A-451 VII.E5.A-451 VII.F1.A-451 VII.F2.A-451 VII.F3.A-451 VII.F4.A-451 VII.G.A-451 VII.H1.A-451 VII.H2.A-451
N	190	BWR/PWR	Aluminum piping, piping components, tanks exposed to raw water, waste water, condensation (external)	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.I.A-452
N	191	BWR/PWR	Aluminum piping, piping components, tanks exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.I.A-707
N	192	BWR/PWR	Aluminum underground piping, piping components, tanks exposed to air – outdoor, raw water, condensation	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.I.A-706
N	193	BWR/PWR	Steel components exposed to treated water, raw water, waste water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No	VII.A4.A-439 VII.C1.A-469 VII.E1.A-439 VII.E3.A-439 VII.E4.A-532 VII.E5.A-469

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
							VII.G.A-651 VII.H2.A-651
N	194	BWR/PWR	PVC piping, piping components, and tanks exposed to soil, concrete	Loss of material due to wear	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VII.E5.A-537 VII.G.A-537
N	195	BWR/PWR	Concrete, cementitious material piping, piping components exposed to raw water	Changes in material properties due to aggressive chemical attack	AMP XI.M27, "Fire Water System"	No	VII.G.A-647
N	196	BWR/PWR	HDPE piping, piping components exposed to raw water	Cracking, blistering, change in color due to water absorption	AMP XI.M27, "Fire Water System"	No	VII.G.A-648
N	197	BWR/PWR	Fire water system piping, piping components, heat exchanger, heat exchanger components (any material) with only a leakage boundary (spatial) or structural integrity (attached) intended function	Loss of material due to general (steel and copper alloy only), pitting, crevice corrosion, MIC	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VII.G.A-649
N	198	BWR/PWR	Fire water system piping, piping components, heat exchanger, heat exchanger components (any material) with only a leakage boundary (spatial) or structural integrity (attached) intended function	Loss of material due to general (steel and copper alloy only), pitting, crevice corrosion, MIC, fouling that leads to corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.G.A-650

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	199	BWR/PWR	Steel structural bolting exposed to air – indoor uncontrolled, air – outdoor	Loss of preload due to self-loosening	AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	VII.B.A-730
N	200	BWR/PWR	High-strength steel structural bolting exposed to air – indoor uncontrolled, air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	No	VII.B.A-731
N	202	BWR/PWR	Stainless steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.3.2.2.11)	VII.J.AP-19
N	203	BWR	Stainless steel; steel with stainless steel cladding, piping, piping components, heat exchanger components exposed to treated water, sodium pentaborate solution	Loss of material due to pitting, crevice corrosion, MIC	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.12)	VII.A4.AP-110 VII.E3.AP-110 VII.E4.AP-110 VII.A4.AP-111 VII.E2.AP-141

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	204	BWR/PWR	Stainless steel, steel, aluminum, copper alloy, titanium heat exchanger components internal to components exposed to air (external), condensation	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-733 VII.C2.A-733 VII.D.A-733 VII.F1.A-733 VII.F2.A-733 VII.F3.A-733 VII.F4.A-733 VII.H2.A-733
N	205	BWR/PWR	Insulated stainless steel piping, piping components, tanks exposed to air – indoor uncontrolled, air – indoor controlled, condensation, air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.I.A-734
N	206	PWR	Copper alloy (≤8% Al) piping, piping components exposed to air with borated water leakage	None	None	No	VII.J.A-735
N	207	BWR/PWR	Stainless steel, copper alloy, titanium heat exchanger tubes exposed to raw water (for components not covered by NRC GL 89-13)	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-736
N	208	BWR/PWR	Reinforced concrete, asbestos cement piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Cracking due to aggressive chemical attack and leaching; changes in material properties due to aggressive chemical attack	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-737

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	209	BWR/PWR	Fiberglass piping, piping components exposed to raw water (internal) (for components not covered by NRC GL 89-13)	Cracking, blistering, change in color due to water absorption	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-738
N	210	BWR/PWR	HDPE piping, piping components exposed to raw water (internal) (for components not covered by NRC GL 89-13)	Cracking, blistering, change in color due to water absorption	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-739
N	211	BWR/PWR	Concrete, cementitious material piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Cracking due to settling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-740
N	212	BWR/PWR	Concrete, cementitious material piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Loss of material due to abrasion, cavitation, aggressive chemical attack, leaching	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-741

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
N	213	BWR/PWR	Concrete, cementitious material piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Changes in material properties due to aggressive chemical attack	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.C1.A-742
N	214	BWR/PWR	Copper alloy (>15% Zn or >8% Al) piping, piping components exposed to soil ground water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No	VII.C1.A-743 VII.C2.A-743 VII.C3.A-743 VII.D.A-743 VII.E4.A-743 VII.E5.A-743 VII.G.A-743 VII.H1.A-743 VII.H2.A-743
N	215	BWR/PWR	Aluminum fire water storage tanks exposed to air – indoor uncontrolled, air – outdoor, condensation, moist air, raw water, treated water, soil, concrete	Loss of material due to pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	No	VII.G.A-744
N	216	BWR/PWR	Stainless steel fire water storage tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M27, "Fire Water System"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.G.A-745
N	217	BWR/PWR	Stainless steel fire water storage tanks exposed to air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M27, "Fire Water System"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.G.A-746
N	218	BWR/PWR	Stainless steel fire water storage tanks exposed to air – indoor uncontrolled, condensation, moist air, raw	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M27, "Fire Water System"	No	VII.G.A-747

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	**ID**	**Type**	**Component**	**Aging Effect/Mechanism**	**Aging Management Program (AMP)/TLAA**	**Further Evaluation Recommended**	**GALL-SLR Item**
			water, treated water, soil, concrete				
N	219	BWR/PWR	Stainless steel piping, piping components exposed to steam	Cracking due to stress corrosion cracking	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VII.F1.A-748 VII.F2.A-748 VII.F3.A-748 VII.F4.A-748
M	220	BWR/PWR	Steel, copper alloy piping, piping components exposed to moist air, condensation (internal)	Loss of material due to general, pitting, crevice corrosion	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VII.H2.A-23
N	221	BWR/PWR	Aluminum piping, piping components exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.C1.A-750 VII.C2.A-750 VII.C3.A-750 VII.D.A-750 VII.E1.A-750 VII.E4.A-750 VII.F1.A-750 VII.F2.A-750 VII.F4.A-750 VII.G.A-750 VII.H1.A-750 VII.H2.A-750
N	222	BWR/PWR	Stainless steel tanks exposed to air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.I.A-751

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
N	223	BWR/PWR	Aluminum underground piping, piping components exposed to air (external)	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.13)	VII.I.A-752
N	224	BWR/PWR	Aluminum piping, piping components exposed to air – outdoor (external)	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.I.A-753
N	225	BWR/PWR	Aluminum tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.I.A-754
N	226	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	No	VII.C3.A-755 VII.E5.A-755 VII.H1.A-755
N	227	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air (external)	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.13)	VII.C3.A-756 VII.E5.A-756 VII.H1.A-756
N	228	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air – outdoor, air – indoor uncontrolled, moist air, raw water, condensation	Loss of material due to pitting, crevice corrosion, MIC (raw water environment only)	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.C3.A-757 VII.E5.A-757 VII.H1.A-757
N	229	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic	Loss of material due to pitting, crevice corrosion, MIC	AMP XI.M29, "Aboveground Metallic Tanks"	No	VII.C3.A-758 VII.E5.A-758 VII.H1.A-758

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL-SLR Report							
New (N), Modified (M), Deleted (D) Item	ID	Type	Component	Aging Effect/Mechanism	Aging Management Program (AMP)/TLAA	Further Evaluation Recommended	GALL-SLR Item
			Tanks") exposed to soil, ground water				
N	230	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	No	VII.C3.A-759 VII.E5.A-759 VII.H1.A-759
N	231	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air – outdoor, air – indoor uncontrolled, air – indoor controlled, condensation	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.3.2.2.3)	VII.C3.A-760 VII.E5.A-760 VII.H1.A-760
N	232	BWR/PWR	Insulated stainless steel piping, piping components, tanks exposed to condensation, air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.4)	VII.I.A-761
N	233	BWR/PWR	Insulated aluminum piping, piping components, tanks exposed to condensation, air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.3.2.2.10)	VII.I.A-762
N	234	BWR/PWR	Aluminum piping, piping components exposed to air – dry, air– indoor uncontrolled, air– indoor controlled	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.3.2.2.13	VII.J.A-763

Table 3.3-2. AMPs and Additional Guidance Appendices Recommended for Aging Management of Auxiliary Systems	
GALL-SLR Report Chapter/AMP	**Program Name**
AMP XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
AMP XI.M2	Water Chemistry
AMP XI.M7	Boiling Water Reactor Stress Corrosion Cracking
AMP XI.M10	Boric Acid Corrosion
AMP XI.M17	Flow-Accelerated Corrosion
AMP XI.M18	Bolting Integrity
AMP XI.M20	Open-Cycle Cooling Water System
AMP XI.M21A	Closed Treated Water Systems
AMP XI.M22	Boraflex Monitoring
AMP XI.M23	Inspection of Overhead Heavy and Light Loads (Related to Refueling) Handling Systems
AMP XI.M24	Compressed Air Monitoring
AMP XI.M25	Boiling Water Reactor Cleanup System
AMP XI.M26	Fire Protection
AMP XI.M27	Fire Water System
AMP XI.M29	Aboveground Metallic Tanks
AMP XI.M30	Fuel Oil Chemistry
AMP XI.M32	One-Time Inspection
AMP XI.M33	Selective Leaching
AMP XI.M36	External Surfaces Monitoring of Mechanical Components
AMP XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
AMP XI.M39	Lubricating Oil Analysis
AMP XI.M40	Monitoring of Neutron-Absorbing Materials Other than Boraflex
AMP XI.M41	Buried and Underground Piping and Tanks
AMP XI.M42	Internal Coatings/Linings for In Scope Piping, Piping Components, Heat Exchangers, and Tanks
AMP XI.S6	Structures Monitoring
Appendix for GALL-SLR	Quality Assurance for Aging Management Programs
GALL-SLR Report Appendix B	Operating Experience for Aging Management Programs
SRP-SLR Appendix A	Aging Management Review—Generic (Branch Technical Position RLSB-1)

3.4 Aging Management of Steam and Power Conversion System

Review Responsibilities

Primary—Branch assigned responsibility by Project Manager (PM) as described in Section 3.0 of this Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR).

3.4.1 Areas of Review

This section addresses the aging management review (AMR) and the associated aging management programs (AMPs) of the steam and power conversion system. 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). The steam and power conversion systems contained in this review plan section are generally consistent with those contained in NUREG–0800 except for the condenser circulating water and the condensate storage systems. For older plants, the location of applicable information is plant-specific because an older plant's FSAR may have predated NUREG–0800.

Typical steam and power conversion systems that are subject to an AMR for subsequent license renewal (SLR) are steam turbine, main steam, extraction steam, feedwater, condensate, steam generator blowdown, and auxiliary feedwater (AFW). This review plan section also includes structures and components (SCs) in nonsafety-related systems that are not connected to safety-related systems, structures, and components (SSCs) but have a spatial relationship such that their failure could adversely impact the performance of a safety-related SSC-intended function. Examples of such nonsafety-related systems may be extraction steam, plant heating steam/auxiliary boilers and hot water heating systems.

The aging management for the steam generator is reviewed following the guidance in Section 3.1 of this SRP-SLR. The aging management for portions of the boiling water reactor (BWR) main steam and main feedwater systems, extending from the reactor vessel to the outermost containment isolation valve, is reviewed separately following the guidance in Section 3.1 of this SRP-SLR.

The responsible review organization is to review the following subsequent license renewal application (SLRA) AMR and AMP items assigned to it, per SRP-SLR Section 3.0:

AMRs

- AMR results consistent with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
- AMR results for which further evaluation is recommended
- AMR results not consistent with or not addressed in the GALL-SLR Report

AMPs

- Consistent with the GALL-SLR Report AMPs
- Plant-specific AMPs

FSAR Supplement

- The responsible review organization is to review the FSAR Supplement associated with each assigned AMP.

3.4.2 Acceptance Criteria

The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the U.S. Nuclear Regulatory Commission (NRC) regulations in 10 CFR 54.21.

3.4.2.1 Aging Management Review Results Consistent With the Generic Aging Lessons Learned for Subsequent License Renewal Report

The AMR and the AMPs applicable to the steam and power conversion system are described and evaluated in Chapter VIII of the GALL-SLR Report.

The applicant's SLRA should provide sufficient information so that the NRC reviewer is able to confirm that the specific SLRA AMR item and the associated SLRA AMP are consistent with the cited GALL-SLR Report AMR item. The reviewer should then confirm that the SLRA AMR item is consistent with the GALL-SLR Report AMR item to which it is compared.

When the applicant is crediting a different AMP than recommended in the GALL-SLR Report, the reviewer should confirm that the alternate AMP is valid to use for aging management and will be capable of managing the effects of aging as adequately as the AMP recommended by the GALL-SLR Report.

3.4.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic acceptance criteria, defined in Subsection 3.4.2.1, need to be applied first for all of the AMRs and AMPs reviewed as part of this section. In addition, if the GALL-SLR Report AMR item to which the SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.4-1, comparing the "Further Evaluation Recommended" and the "GALL-SLR Item" column, for the AMR items that reference the following subsections.

3.4.2.2.1 Cumulative Fatigue Damage

Fatigue is a time-limited aging analysis (TLAA) as defined in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-SLR. The related GALL-SLR Report items invoked by Table 3.4-1 item 1 are VIII.D1.S-11, VIII.D2.S-11, VIII.G.S-11, VIII.B1.S-08, VIII.B2.S-08.

3.4.2.2.2 Cracking Due to Stress Corrosion Cracking

Cracking due to SCC could occur for SS piping, piping components, and tanks exposed to outdoor air or any air environment when the component is insulated. The possibility of cracking also extends to indoor components located in close proximity to sources of outdoor air (e.g., components near intake vents). Cracking is known to occur in environments containing sufficient halides (e.g., chlorides) and in which moisture is possible.

Applicable outdoor air environments (and associated local indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, within 1/2 mile of a road which is treated with salt in the wintertime, areas in which the soil contains more than trace chlorides, plants having cooling towers where the water is treated with chlorine or chlorine compounds, and areas subject to chloride contamination from other agricultural or industrial sources.

Insulated SS components exposed to indoor air environments and outdoor air environments are susceptible to SCC if the insulation contains certain contaminants. Leakage of fluids through bolted connections (e.g., flanges, valve packing) can result in contaminants present in the insulation leaching onto the component surface. For outdoor insulated SS components, rain and changing weather conditions can result in moisture intrusion of the insulation.

The applicant may demonstrate that SCC is not expected to occur by one or more of the following applicable means.

- For outdoor uninsulated components, describing the outdoor air environment present at the plant and demonstrating that SCC is not expected.
- For underground components, the applicant may demonstrate that SCC due to exposure to in-leakage to the vault as a result of external precipitation or groundwater is not expected.
- For insulated components, determining that the insulation does not contain sufficient contaminants to cause SCC. One acceptable means to demonstrate this is provided by Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel."
- For indoor components, determining that there are no liquid-filled systems with threaded or bolted connections (e.g., flanges, valve packing) that could leak onto the component.
- For all components, demonstrating that the aggressive environment is not present by isolating the component from the environment using a barrier to prevent loss of material due to pitting or crevice corrosion. An acceptable barrier includes tightly-adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating a component from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," is an acceptable method to manage the integrity of a barrier coating for internal or external coatings.

The GALL-SLR Report recommends further evaluation to determine whether an AMP is needed to manage this aging effect based on the environmental conditions applicable to the plant and requirements applicable to the components. GALL-SLR AMP XI.M36, "External Surfaces Monitoring," GALL-SLR AMP XI.M29, "Aboveground Metallic Tanks," or AMP XI.M41, "Buried and Underground Piping and Tanks," (for underground components) are acceptable methods to manage cracking of SS due to SCC in piping, piping components, and tanks.

3.4.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur in SS piping, piping components, and tanks exposed to outdoor air or any air environment when the component is insulated or where the component is in the vicinity of insulated components. The possibility of pitting and crevice corrosion also extends to indoor components located in close proximity to sources of outdoor air (e.g., components near intake vents). Pitting and crevice corrosion is known to occur in environments containing sufficient halides (e.g., chlorides) and in which the presence of moisture is possible.

Applicable outdoor air environments (and associated local indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, within 1/2 mile of a road which is treated with salt in the wintertime, areas in which the soil contains more than trace chlorides, plants having cooling towers where the water is treated with chlorine or chlorine compounds, and areas subject to chloride contamination from other agricultural or industrial sources.

Insulated SS components exposed to indoor air environments and outdoor air environments are susceptible to loss of material due to pitting or crevice corrosion if the insulation contains certain contaminants. Leakage of fluids through mechanical connections such as bolted flanges and valve packing can result in contaminants leaching onto the component surface. For outdoor insulated SS components, rain and changing weather conditions can result in moisture intrusion of the insulation.

The applicant may demonstrate that loss of material due to pitting and crevice corrosion is not expected to occur by one or more of the following applicable means.

- For outdoor uninsulated components, describing the outdoor air environment present at the plant and demonstrating that external pitting or crevice corrosion is not expected.
- For underground components, the applicant may demonstrate that loss of material due to pitting or crevice corrosion due to exposure to in-leakage to the vault as a result of external precipitation or groundwater is not expected.
- For insulated components, determining that the insulation does not contain sufficient contaminants to cause loss of material due to pitting or crevice corrosion. One acceptable means to demonstrate this is provided by Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel."
- For indoor components, determining that there are no liquid-filled systems with threaded or bolted connections (e.g., flanges, valve packing) that could leak onto the component.
- For all components, demonstrating that the aggressive environment is not present by isolating the component from the environment using a barrier to prevent loss of material due to pitting or crevice corrosion. An acceptable barrier includes coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating a component from a potentially aggressive environment, then the barrier coating is evaluated to verify that it is impervious to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers,

and Tanks," is an acceptable method to manage the integrity of a barrier coating for internal or external coatings.

The GALL-SLR Report recommends further evaluation to determine whether an AMP is needed to manage this aging effect based on the environmental conditions applicable to the plant and requirements applicable to the components. GALL-SLR AMP XI.M36, "External Surfaces Monitoring," GALL-SLR AMP XI.M29, "Aboveground Metallic Tanks," or AMP XI.M41, "Buried and Underground Piping and Tanks," (for underground components) are acceptable methods to manage loss of material due to pitting and crevice corrosion in SS piping, piping components, and tanks.

3.4.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's AMPs for SLR should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an AMP for SLR. Nevertheless, the applicant has the option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address these program elements. If the applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR Supplement. If the applicant chooses alternative means, the branch responsible for quality assurance (QA) should be requested to review the applicant's proposal on a case-by-case basis.

Acceptance criteria are described in Branch Technical Position (BTP) IQMB-1 (Appendix A.2, of this SRP-SLR Report).

3.4.2.2.5 Ongoing Review of Operating Experience

Acceptance criteria are described in Appendix A.4, "Operating Experience for Aging Management Programs."

3.4.2.2.6 Loss of Material Due to Recurring Internal Corrosion

Recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL-SLR Report. During the search of plant-specific operating experience conducted during the SLRA development, recurring internal corrosion can be identified by the number of occurrences of aging effects and the extent of degradation at each localized corrosion site. This further evaluation item is applicable if the search of plant-specific operating experience reveals repetitive occurrences (e.g., one per refueling outage cycle that has occurred: (a) in any three or more cycles for a 10-year operating experience search, or (b) in any two or more cycles for a 5-year operating experience search) of aging effects with the same aging mechanism in which the aging effect resulted in the component either not meeting plant-specific acceptance criteria or experiencing a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness).

The GALL-SLR Report recommends that a plant-specific AMP, or a new or existing AMP, be evaluated for inclusion of augmented requirements to ensure the adequate management of any recurring aging effect(s). Potential augmented requirements include: (i) alternative examination methods (e.g., volumetric versus external visual); (ii) augmented inspections (e.g., a greater number of locations, additional locations based on risk insights based on susceptibility to aging effect and consequences of failure, a greater frequency of inspections), and (iii) additional trending parameters and decision points where increased inspections would be implemented. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report)."

The applicant states: (a) why the program's examination methods will be sufficient to detect the recurring aging effect before affecting the ability of a component to perform its intended function, (b) the basis for the adequacy of augmented or lack of augmented inspections, (c) what parameters will be trended as well as the decision points where increased inspections would be implemented (e.g., the extent of degradation at individual corrosion sites, the rate of degradation change), (d) how inspections of components that are not easily accessed (i.e., buried, underground) will be conducted, and (e) how leaks in any involved buried or underground components will be identified.

Plant-specific operating experience examples should be evaluated to determine if the chosen AMP should be augmented even if the thresholds for significance of aging effect or frequency of occurrence of aging effect have not been exceeded. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the current licensing basis (CLB) intended functions of the component will be met throughout the subsequent period of extended operation. Likewise, the GALL-SLR Report AMR items associated with the new further evaluation items only cite raw water and waste water environments because operating experience indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific operating experience reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

3.4.2.2.7 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

SCC is a form of environmentally assisted cracking which is known to occur in high and moderate strength aluminum alloys. The three conditions necessary for SCC to occur in a component are a sustained tensile stress, aggressive environment, and material with a susceptible microstructure. The aging effect of cracking due to SCC can be mitigated by eliminating one of the three necessary conditions. For the purposes of SLR, acceptance criteria for this further evaluation is being provided for demonstrating that the specific material is not susceptible to SCC or an aggressive environment is not present. The susceptibility of the material is to be established prior to evaluating the environment. This further evaluation item is applicable unless it is demonstrated by the applicant that one of the two necessary conditions discussed below is absent.

Susceptible Material: If the material that a component is constructed of is not susceptible to SCC then the aging effect is not applicable. The microstructure of an aluminum alloy, of which alloy composition is only one factor, is what determines if the alloy is susceptible to SCC. Therefore, providing guidance based on alloy composition will not always successfully protect against SCC in aluminum alloys. The temper, condition, and product form of the alloy is considered when assessing if a material is susceptible to SCC. Aluminum alloys that are susceptible to SCC include:

- 2xxx series alloys in the F, W, Ox, T3x, T4x, or T6x temper
- 5xxx series alloys with a magnesium content of 3.5 weight percent or greater

- 6xxx series alloys in the F temper
- 7xxx series alloys in the F, T5x, or T6x temper
- 2xx.x and 7xx.x series alloys
- 3xx.x series alloys that contain copper
- 5xx.x series alloys with a magnesium content of greater than 8 weight percent

The material is evaluated to verify that it is not susceptible to SCC and that the basis used to make the determination is technically substantiated. Tempers have been specifically developed to improve the SCC resistance for some aluminum alloys. Aluminum alloy and temper combination which are not susceptible to SCC when used in piping, piping component, and tank applications include 1xxx series, 3xxx series, 6061-T6x, and 5454-x.

GALL-SLR Report AMP XI.M29, "Aboveground Metallic Tanks," is an acceptable method to manage cracking of aluminum due to SCC in tanks. GALL-SLR Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," is an acceptable method to manage cracking of aluminum due to SCC in piping and piping components. GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks," is an acceptable method to manage cracking of aluminum due to SCC in piping and tanks which are buried or underground. GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" is an acceptable method to manage cracking of aluminum due to SCC in components that are not included in other AMPs. Additional acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

Aggressive Environment: If the environment that an aluminum alloy is exposed to is not aggressive, such as dry gas, controlled indoor air, or treated water, then cracking due to SCC will not occur and the aging effect is not applicable. Aggressive environments that are known to result in cracking of susceptible aluminum alloys due to SCC are aqueous solutions and atmospheric air that contain halides (e.g., chloride). Halide concentrations should generally be considered high enough to facilitate SCC of aluminum alloys in uncontrolled or untreated aqueous solutions and atmospheric air, such as outdoor air, raw water, waste water, and condensation, unless demonstrated otherwise. If an aluminum component is encapsulated in a secondary material, such as insulation or concrete, the composition of the encapsulating material is evaluated for halides. The environment that the aluminum alloy is exposed to is evaluated to verify that it is either controlled or treated and free of halides.

An alternative strategy to demonstrating that an aggressive environment is not present is to isolate the aluminum alloy from the environment using a barrier to prevent SCC. Acceptable barriers include tightly adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating an aluminum alloy from a potentially aggressive environment then the barrier coating is evaluated to verify that it is imperially to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," or equivalent program is an acceptable method to manage the integrity of a barrier coating.

3.4.2.2.8 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking

Loss of material due to general (steel only), crevice, or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) can occur in steel and SS piping and piping components exposed to concrete. Concrete provides a high alkalinity environment that can mitigate the effects of loss of material for steel piping, thereby significantly reducing the corrosion rate. However, if water intrudes through the concrete, the pH can be reduced and ions that promote loss of material such as chlorides, which can penetrate the protective oxide layer created in the high alkalinity environment, can reach the surface of the metal. Carbonation can reduce the pH within concrete. The rate of carbonation is reduced by using concrete with a low water-to-cement ratio and low permeability. Concrete with low permeability also reduces the potential for the penetration of water. Adequate air entrainment improves the ability of the concrete to resist freezing and thawing cycles and therefore reduces the potential for cracking and intrusion of water. Intrusion of water can also bring bacteria to the surface of the metal, potentially resulting in microbiologically-induced corrosion in steel or SS. Cracking due to SCC, as well as pitting and crevice corrosion can occur due to halides present in the water that penetrates to the surface of the metal.

If the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with American Concrete Institute (ACI) 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to groundwater. For SS components loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice, or pitting corrosion, and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage these aging effects.

3.4.2.2.9 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

Loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 parts per billion (ppb). In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

Where oxygen levels are less than or equal to 100 ppb, GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M32, “One-Time Inspection,” are acceptable methods to manage loss of material due to pitting and crevice corrosion. Where oxygen levels are greater than 100 ppb, GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” are acceptable methods to manage loss of material due to crevice corrosion. Where stagnant flow conditions exist, and oxygen levels are greater than 100 ppb and halides or sulfates levels are greater than 150 ppb, GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” are acceptable methods to manage loss of material due to pitting and crevice corrosion.

Where the pH is greater than or equal to 10.5 and the temperature is greater than or equal to 99 °C [210 °F], GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M32, “One-Time Inspection,” are acceptable methods to manage loss of material due to loss of material due to microbiologically-induced corrosion. Where the pH is less than 10.5 and temperature is less than 99 °C [210 °F], GALL-SLR Report AMP XI.M2, “Water Chemistry,” and GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” are acceptable methods to manage loss of material due to microbiologically-induced corrosion.

3.4.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

Loss of material due to pitting and crevice corrosion could occur in aluminum piping, piping components, and tanks exposed to an air environment for a sufficient duration of time. Air environments known to result in pitting and/or crevice corrosion of aluminum alloys are those that contain halides (e.g., chloride) and periodic moisture. The moisture level and halide concentration in atmospheric and uncontrolled air are greatly dependent on geographical location and site-specific conditions. Moisture level and halide concentration should generally be considered high enough to facilitate pitting and/or crevice corrosion of aluminum alloys in atmospheric and uncontrolled air, unless demonstrated otherwise. The periodic introduction of moisture or halides into an air environment from secondary sources should also be considered. Leakage of fluids from mechanical connections, such as bolted flanges and valve packing, through insulation onto a component in indoor controlled air is an example of a secondary source that should be considered. The operating experience (OE) and condition of aluminum alloy components are evaluated to determine if the plant-specific air environment is aggressive enough to result in pitting and crevice corrosion after prolonged exposure. The aging effect of loss of material due to pitting and crevice corrosion in aluminum alloys is not applicable and does not require management if: (a) the plant-specific OE does not reveal a history of pitting or crevice corrosion and (b) a one-time inspection demonstrates that the aging effect is not occurring or that loss of material due to pitting or crevice corrosion is occurring so slowly that it will not affect the intended function of the components.

The internal surfaces of aluminum components do not need to be inspected if: (a) the review of OE does not reveal a history of pitting or crevice corrosion; and (b) inspection results for external surfaces demonstrate that the aging effect is not applicable. Inspection results associated with the periodic introduction of moisture or halides from secondary sources may be treated as a separate population of components. In the environment of air-indoor controlled, pitting and crevice corrosion is only expected to occur as the result of secondary source of moisture or halides. Alloy susceptibility may be considered when reviewing OE and interpreting inspection results. Inspections focus on the most susceptible alloys and locations.

The GALL-SLR Report recommends the further evaluation of aluminum piping, piping components, and tanks exposed to an air environment to determine whether an AMP is needed to manage the aging effect of loss of material due to pitting and crevice corrosion. GALL-SLR Report AMP XI.M32, “One-Time Inspection,” is an acceptable method to demonstrate that the aging effect of loss of material due to pitting and crevice corrosion is not occurring at a rate that affects the intended function of the components. If loss of material due to pitting or crevice corrosion has occurred and is sufficient to potentially affect the intended function of an aluminum SSC, the following AMPs are acceptable methods to manage loss of material due to pitting or crevice corrosion: (i) GALL-SLR Report AMP XI.M29, “Aboveground Metallic Tanks,” for tanks; (ii) GALL-SLR Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components,” for external surfaces of piping and piping components; (iii) GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” for underground piping, piping components and tanks; and (iv) GALL-SLR Report Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components” for internal surfaces of components that are not included in other aging management programs.

3.4.2.3 Aging Management Review Results Not Consistent With or Not Addressed in the Generic Aging Lessons Learned for Subsequent License Renewal Report

Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

3.4.2.4 Aging Management Programs

For those AMPs that will be used for aging management and are based on the program elements of an AMP in the GALL-SLR Report, the NRC reviewer performs an audit of AMPs credited in the SLRA to confirm consistency with the GALL-SLR AMPs identified in the GALL-SLR Report, Chapters X and XI.

If the applicant identifies an exception to any of the program elements of the cited GALL-SLR Report AMP, the SLRA AMP should include a basis demonstrating how the criteria of 10 CFR 54.21(a)(3) would still be met. The NRC reviewer should then confirm that the SLRA AMP with all exceptions would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the SLRA AMP, the reviewer identifies a difference between the SLRA AMP and the GALL-SLR Report AMP that should have been identified as an exception to the GALL-SLR Report AMP, the difference should be reviewed and properly dispositioned. The reviewer should document the disposition of all SLRA-defined exceptions and NRC staff-identified differences.

The SLRA should identify any enhancements that are needed to permit an existing SLRA AMP to be declared consistent with the GALL-SLR Report AMP to which the SLRA AMP is compared. The reviewer is to confirm both that the enhancement, when implemented, would allow the existing SLRA AMP to be consistent with the GALL-SLR Report AMP and also that the applicant has a commitment in the FSAR Supplement to implement the enhancement prior to the subsequent period of extended operation. The reviewer should document the disposition of all enhancements.

If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1.2.3 of this SRP-~~LR~~SLR Report).

3.~~3~~4.2.5 ~~FSAR~~Final Safety Analysis Report Supplement

The summary description of the programs and activities for managing the effects of aging for the subsequent period of extended operation in the FSAR Supplement should be sufficiently comprehensive~~, such~~ that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects will be managed during the subsequent period of extended operation. The description should also contain any future aging management activities, including enhancements and commitments, to be completed before the subsequent period of extended operation. Table 3.0-1 of this SRP-

~~LR~~SLR provides examples of the type of information to be included in the FSAR Supplement. Table 3.~~3~~4-2 lists the programs that are applicable for this SRP-~~LR~~SLR subsection.

~~1.1.2 3.3.3 Review Procedures~~

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

~~*1.1.2.1 3.3.3.1 AMR Results Consistent with the GALL Report*~~

~~The applicant may reference the GALL Report in its LRA, as appropriate, and demonstrate that the AMRs and AMPs at its facility are consistent with those reviewed and approved in the GALL Report. The reviewer should not conduct a re-review of the substance of the matters described in the GALL Report. 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 should find acceptable the applicant's reference to the GALL Report in its LRA. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report.~~

~~Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL Report. Performance of this review requires the reviewer to confirm that the applicant has identified those aging effects for the auxiliary system components that are contained in the GALL Report as applicable to its plant.~~

~~*1.1.2.2 3.3.3.2 AMR Results Report for Which Further Evaluation is Recommended by the GALL Report*~~

~~The basic review procedures defined in Subsection 3.3.3.1 need to be applied first for all of the AMRs and AMPs provided in this section. In addition, if the GALL Report AMR item to which the LRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.3-1 for the items that reference the following subsections.~~

~~*1.1.2.2.1 3.3.3.2.1 Cumulative Fatigue Damage*~~

~~Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3 of this SRP-LR.~~

~~*1.1.2.2.2 3.3.3.2.2 Cracking due to Stress Corrosion Cracking and Cyclic Loading*~~

~~The GALL Report also recommends further evaluation of programs to manage cracking due to SCC and cyclic loading in the stainless steel non-regenerative heat exchangers in the chemical and volume control system (PWR) exposed to treated borated water >60°C (>140°F). The water chemistry program relies on monitoring and control of water chemistry to manage the aging effects of cracking due to SCC and cyclic loading. The GALL Report recommends the effectiveness of the chemistry control program be verified to ensure that cracking is not occurring. The absence of cracking due to SCC and cyclic loading is to be verified. An acceptable verification program is to include temperature and radioactivity monitoring of the~~

~~shell side water, and eddy current testing of tubes. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.~~

~~1.1.2.2.3 3.3.3.2.3 Cracking due to Stress Corrosion Cracking~~

~~The GALL Report recommends further evaluation to manage cracking due to stress corrosion cracking of stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. The possibility of cracking also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents.~~

~~The reviewer should determine whether an adequate program is used to manage the aging effect based on the applicable environmental conditions and ASME Code requirements. Cracking is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above. GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect.~~

~~1.1.2.2.4 3.3.3.2.4 Loss of Material due to Cladding Breach~~

~~The GALL Report recommends further evaluation of programs to manage loss of material due to cladding breach for PWR steel charging pump casings with stainless steel cladding. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks and recommends further evaluation on a plant-specific basis to ensure that the aging effect is adequately managed. The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of general corrosion of these components.~~

~~1.1.2.2.5 3.3.3.2.5 Loss of Material due to Pitting and Crevice Corrosion~~

~~The GALL Report recommends further evaluation to manage loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. The possibility of pitting and crevice corrosion also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. The reviewer should determine whether an adequate program is used to manage the aging effect based on the applicable environmental conditions and ASME Code requirements. Pitting and crevice corrosion is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil~~

~~contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above. GALL AMP XI.M36, “External Surfaces Monitoring,” is an acceptable method to manage the aging effect.~~

~~1.1.2.2.6 3.3.3.2.6 Quality Assurance for Aging Management of Nonsafety-Related Components~~

~~The applicant’s aging management programs for license renewal should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an AMR for license renewal. Nevertheless, the applicant has the 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 the applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR Supplement. If the applicant chooses alternative means, the branch responsible for quality assurance should be requested to review the applicant’s proposal on a case-by-case basis.~~

~~1.1.2.3 3.3.3.3 AMR Results Not Consistent with or Not Addressed in the GALL Report~~

~~The reviewer should confirm that the applicant, in its LRA, has identified applicable aging effects, listed the appropriate combination of materials and environments, and has credited AMPs that will adequately manage the aging effects. The AMP credited by the applicant could be an AMP that is described and evaluated in the GALL Report or a plant-specific program. Review procedures are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).~~

~~1.1.2.4 3.3.3.4 Aging Management Programs~~

~~The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL Report. If the applicant commits to an enhancement to make its LRA AMP consistent with a GALL Report AMP, then the reviewer is to confirm that this enhancement, when implemented, will make the LRA AMP consistent with the GALL Report AMP. If the applicant identifies, in the LRA AMP, an exception to any of the program elements of the GALL Report AMP, the reviewer is to confirm that the LRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3). If the reviewer identifies a difference, not identified by the LRA, between the LRA AMP and the GALL Report AMP with which the LRA claims to be consistent, the reviewer should confirm that the LRA AMP with this difference satisfies 10 CFR 54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions or differences. The AMPs evaluated in the GALL Report pertinent to the auxiliary systems components are summarized in Table 3.3-1 of this SRP-LR. The “Rev 2 Item” (for 2010) and “Rev1 Item” (for 2005 counterpart) columns identify the AMR item numbers in the GALL Report, Chapter VII, presenting detailed information summarized by this row.~~

~~1.1.2.5 3.3.3.5 FSAR Supplement~~

~~The reviewer confirms that the applicant has provided in its FSAR supplement information equivalent to that in Table 3.0-1 for aging management of the auxiliary systems. Table 3.3-2 lists the AMPs that are applicable for this SRP-LR subsection. The reviewer also confirms that~~

~~the applicant has provided information for subsection 3.3.3.3, "AMR Results Not Consistent with or Not Addressed in the GALL Report," equivalent to that in Table 3.0-1.~~

~~The staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR Supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR Supplement without prior NRC approval, provided that the applicant evaluates each such change and finds it acceptable pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.~~

~~As noted in Table 3.0-1, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should confirm that the applicant has identified and committed in the LRA to any future aging management activities, including enhancements and commitments, to be completed before entering the period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.~~

~~1.1.3 3.3.4 Evaluation Findings~~

~~If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of this section, then an evaluation finding similar to the following text should be included in the staff's safety evaluation report:~~

> ~~On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated that the aging effects associated with the auxiliary systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).~~
>
> ~~The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).~~

~~1.1.4 3.3.5 Implementation~~

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

~~1.1.5 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, March 2007.~~

2. ~~NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

3. ~~NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Nuclear Energy Institute, Revision 6.~~

4. ~~ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," The ASME Boiler and Pressure Vessel Code, 2004 edition as approved in 10 CFR 50.55a, The American Society of Mechanical Engineers, New York, NY.~~

5. ~~ASTM D95-83, Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation, American Society for Testing and Materials, West Conshohocken, PA, 1990.~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~1~~	~~BWR/ PWR~~	~~Steel Cranes: structural girders exposed to Air – indoor, uncontrolled (External)~~	~~Cumulative fatigue damage~~ ~~due to fatigue~~	~~Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54 (Standard Review Plan, Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1))~~	~~Yes, TLAA (See subsection 3.3.2.2.1)~~	~~VII.B.A-06~~	~~VII.B-2(A-06)~~
~~2~~	~~BWR/ PWR~~	~~Stainless steel, Steel Heat exchanger components and tubes, Piping, piping components, and piping elements exposed to Treated borated water, Air - indoor, uncontrolled, Treated water~~	~~Cumulative fatigue damage~~ ~~due to fatigue~~	~~Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).~~	~~Yes, TLAA (See subsection 3.3.2.2.1)~~	~~VII.E1.A-100~~ ~~VII.E1.A-34~~ ~~VII.E1.A-57~~ ~~VII.E3.A-34~~ ~~VII.E3.A-62~~ ~~VII.E4.A-62~~	~~VII.E1-4(A-100)~~ ~~VII.E1-18(A-34)~~ ~~VII.E1-16(A-57)~~ ~~VII.E3-17(A-34)~~ ~~VII.E3-14(A-62)~~ ~~VII.E4-13(A-62)~~
~~3~~	~~PWR~~	~~Stainless steel Heat exchanger components, non-regenerative exposed to Treated borated water >60°C (>140°F)~~	~~Cracking~~ ~~due to stress corrosion cracking; cyclic loading~~	~~Chapter XI.M2, "Water Chemistry"~~ ~~The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. An acceptable verification program is to include~~	~~Yes, plant-specific (See subsection 3.3.2.2.2)~~	~~VII.E1.A-69~~	~~VII.E1-9(A-69)~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
				~~temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.~~			
~~4~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~Yes, environmental conditions need to be evaluated (See subsection 3.3.2.2.3)~~	~~VII.C1.AP-209~~ ~~VII.C2.AP-209~~ ~~VII.C3.AP-209~~ ~~VII.D.AP-209~~ ~~VII.E1.AP-209~~ ~~VII.E4.AP-209~~ ~~VII.F1.AP-209~~ ~~VII.F2.AP-209~~ ~~VII.F4.AP-209~~ ~~VII.G.AP-209~~ ~~VII.H1.AP-209~~ ~~VII.H2.AP-209~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~
~~5~~	~~PWR~~	~~Steel (with stainless steel or nickel-alloy cladding) Pump~~	~~Loss of material~~ ~~due to cladding breach~~	~~A plant-specific aging management program is to be evaluated.~~	~~Yes, verify that plant-specific program addresses clad~~	~~VII.E1.AP-85~~	~~VII.E1-21(AP-85)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~Casings exposed to Treated borated water~~		~~Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."~~	~~cracking (See subsection 3.3.2.2.4)~~		
~~6~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor~~	~~Loss of material due to pitting and crevice corrosion~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~Yes, environmental conditions need to be evaluated (See subsection 3.3.2.2.5)~~	~~VII.C1.AP-221~~ ~~VII.C2.AP-221~~ ~~VII.C3.AP-221~~ ~~VII.D.AP-221~~ ~~VII.E1.AP-221~~ ~~VII.E4.AP-221~~ ~~VII.F1.AP-221~~ ~~VII.F2.AP-221~~ ~~VII.F4.AP-221~~ ~~VII.G.AP-221~~ ~~VII.H1.AP-221~~ ~~VII.H2.AP-221~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~**ID**~~	~~**Type**~~	~~**Component**~~	~~**Aging Effect/ Mechanism**~~	~~**Aging Management Programs**~~	~~**Further Evaluation Recommended**~~	~~**Rev2 Item**~~	~~**Rev1 Item**~~
~~7~~	~~PWR~~	~~Stainless steel High-pressure pump, casing exposed to Treated borated water~~	~~Cracking~~ ~~due to cyclic loading~~	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"~~	~~No~~	~~VII.E1.AP-115~~	~~VII.E1-7(A-76)~~
~~8~~	~~PWR~~	~~Stainless steel Heat exchanger components and tubes exposed to Treated borated water >60°C (>140°F)~~	~~Cracking~~ ~~due to cyclic loading~~	~~Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"~~	~~No~~	~~VII.E1.AP-119~~	~~N/A~~
~~9~~	~~PWR~~	~~Steel, Aluminum, Copper alloy (>15% Zn or >8% Al) External surfaces, Piping, piping components, and piping elements, Bolting exposed to Air with borated water leakage~~	~~Loss of material~~ ~~due to boric acid corrosion~~	~~Chapter XI.M10, "Boric Acid Corrosion"~~	~~No~~	~~VII.A3.A-79~~ ~~VII.A3.AP-1~~ ~~VII.E1.A-79~~ ~~VII.E1.AP-1~~ ~~VII.I.A-102~~ ~~VII.I.A-79~~ ~~VII.I.AP-66~~	~~VII.A3-2(A-79)~~ ~~VII.A3-4(AP-1)~~ ~~VII.E1-1(A-79)~~ ~~VII.E1-10(AP-1)~~ ~~VII.I-2(A-102)~~ ~~VII.I-10(A-79)~~ ~~VII.I-12(AP-66)~~
~~10~~	~~BWR/ PWR~~	~~Steel, high-strength Closure bolting exposed to Air with~~	~~Cracking~~ ~~due to stress corrosion~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~VII.I.A-04~~	~~VII.I-3(A-04)~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~steam or water leakage~~	~~cracking; cyclic loading~~				
~~11~~	~~BWR/ PWR~~	~~Steel, high-strength High-pressure pump, closure bolting exposed to Air with steam or water leakage~~	~~Cracking due to stress corrosion cracking; cyclic loading~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~VII.E1.AP-122~~	~~VII.E1-8(A-104)~~
~~12~~	~~BWR/ PWR~~	~~Steel; stainless steel Closure bolting, Bolting exposed to Condensation, Air – indoor, uncontrolled (External), Air – outdoor (External)~~	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~VII.D.AP-121~~ ~~VII.I.AP-125~~ ~~VII.I.AP-126~~	~~VII.D-1(A-103)~~ ~~VII.I-4(AP-27)~~ ~~VII.I-1(AP-28)~~
~~13~~	~~BWR/ PWR~~	~~Steel Closure bolting exposed to Air with steam or water leakage~~	~~Loss of material due to general corrosion~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~VII.I.A-03~~	~~VII.I-6(A-03)~~
~~14~~	~~BWR/ PWR~~	~~Steel, Stainless Steel Bolting exposed to Soil~~	~~Loss of preload~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~VII.I.AP-242~~ ~~VII.I.AP-244~~	~~N/A~~ ~~N/A~~
~~15~~	~~BWR/ PWR~~	~~Steel; stainless steel, Copper alloy, Nickel alloy, Stainless steel~~	~~Loss of preload~~	~~Chapter XI.M18, "Bolting Integrity"~~	~~No~~	~~VII.I.AP-124~~	~~VII.I-5(AP-26)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~Closure bolting, Bolting exposed to Air – indoor, uncontrolled (External), Any environment, Air – outdoor (External), Raw water, Treated borated water, Fuel oil, Treated water~~	~~due to thermal effects, gasket creep, and self-loosening~~			~~VII.I.AP-261~~ ~~VII.I.AP-262~~ ~~VII.I.AP-263~~ ~~VII.I.AP-264~~ ~~VII.I.AP-265~~ ~~VII.I.AP-266~~ ~~VII.I.AP-267~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~
~~16~~	~~BWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Treated water >60°C (>140°F)~~	~~Cracking~~ ~~due to stress corrosion cracking, intergranular stress corrosion cracking~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M25, "BWR Reactor Water Cleanup System"~~	~~No~~	~~VII.E3.AP-283~~	~~VII.E3-16(A-60)~~
~~17~~	~~BWR~~	~~Stainless steel Heat exchanger tubes exposed to Treated water~~	~~Reduction of heat transfer~~ ~~due to fouling~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.A4.AP-139~~	~~VII.A4-4(AP-62)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~18~~	~~BWR/ PWR~~	~~Stainless steel High-pressure pump, casing, Piping, piping components, and piping elements exposed to Treated borated water >60°C (>140°F), Sodium pentaborate solution >60°C (>140°F)~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.E1.AP-114~~ ~~VII.E2.AP-181~~	~~VII.E1-7(A-76)~~ ~~VII.E2-2(A-59)~~
~~19~~	~~BWR/ PWR~~	~~Stainless steel Regenerative heat exchanger components exposed to Treated water >60°C (>140°F)~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.E3.AP-120~~	~~VII.E3-19(A-85)~~
~~20~~	~~BWR/ PWR~~	~~Stainless steel, Stainless steel; steel with stainless steel cladding Heat exchanger components exposed to Treated borated water >60°C (>140°F), Treated water >60°C (>140°F)~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.E1.AP-118~~ ~~VII.E3.AP-112~~	~~VII.E1-5(A-84)~~ ~~VII.E3-3(A-71)~~
~~21~~	~~BWR~~	~~Steel Piping, piping components, and piping elements~~	~~Loss of material~~	~~Chapter XI.M2, "Water Chemistry," and~~	~~No~~	~~VII.E3.AP-106~~	~~VII.E3-18(A-35)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~exposed to Treated water~~	~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M32, "One-Time Inspection"~~		~~VII.E4.AP-106~~	~~VII.E4-17(A-35)~~
~~22~~	~~BWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Treated water~~	~~Loss of material~~ ~~due to general, pitting, crevice, and galvanic corrosion~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.A4.AP-140~~ ~~VII.E3.AP-140~~ ~~VII.E4.AP-140~~	~~VII.A4-7(AP-64)~~ ~~VII.E3-9(AP-64)~~ ~~VII.E4-7(AP-64)~~
~~23~~	~~BWR/ PWR~~	~~Aluminum Piping, piping components, and piping elements exposed to Treated water~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.C2.AP-257~~ ~~VII.H2.AP-258~~	~~N/A~~ ~~N/A~~
~~24~~	~~BWR~~	~~Aluminum Piping, piping components, and piping elements exposed to Treated water~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.E4.AP-130~~	~~VII.E4-4(AP-38)~~
~~25~~	~~BWR~~	~~Stainless steel, Stainless steel; steel with stainless steel cladding, Aluminum Piping, piping components, and piping elements, Heat exchanger~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.A4.AP-110~~ ~~VII.A4.AP-111~~ ~~VII.A4.AP-130~~ ~~VII.E2.AP-141~~	~~VII.A4-11(A-58)~~ ~~VII.A4-2(A-70)~~ ~~VII.A4-5(AP-38)~~ ~~VII.E2-1(AP-73)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~components exposed to Treated water, Sodium pentaborate solution~~				~~VII.E3.AP-110~~ ~~VII.E3.AP-130~~ ~~VII.E4.AP-110~~	~~VII.E3-15(A-58)~~ ~~VII.E3-7(AP-38)~~ ~~VII.E4-14(A-58)~~
~~26~~	~~BWR/ PWR~~	~~Steel (with elastomer lining), Steel (with elastomer lining or stainless steel cladding) Piping, piping components, and piping elements exposed to Treated water~~	~~Loss of material~~ ~~due to pitting and crevice corrosion (only for steel after lining/cladding degradation)~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.A3.AP-107~~ ~~VII.A4.AP-108~~	~~VII.A3-9(A-39)~~ ~~VII.A4-12(A-40)~~
~~27~~	~~BWR~~	~~Stainless steel Heat exchanger tubes exposed to Treated water~~	~~Reduction of heat transfer~~ ~~due to fouling~~	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.E3.AP-139~~	~~VII.E3-6(AP-62)~~
~~28~~	~~BWR/ PWR~~	~~Stainless steel, Steel (with stainless steel or nickel-alloy cladding) Spent fuel storage racks (BWR), Spent fuel storage racks (PWR), Piping, piping components, and piping elements,~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M2, "Water Chemistry"~~	~~No~~	~~VII.A2.A-96~~ ~~VII.A2.A-97~~ ~~VII.A3.A-56~~ ~~VII.E1.AP-82~~	~~VII.A2-6(A-96)~~ ~~VII.A2-7(A-97)~~ ~~VII.A3-10(A-56)~~ ~~VII.E1-20(AP-82)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~Piping, piping components, and piping elements; tanks exposed Treated water >60°C (>140°F), Treated borated water >60°C (>140°F)~~					
~~29~~	~~BWR/ PWR~~	~~Steel (with stainless steel cladding); stainless steel Piping, piping components, and piping elements exposed to Treated borated water~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M2, "Water Chemistry"~~	~~No~~	~~VII.A2.AP-79~~ ~~VII.A3.AP-79~~ ~~VII.E1.AP-79~~	~~VII.A2-1(AP-79)~~ ~~VII.A3-8(AP-79)~~ ~~VII.E1-17(AP-79)~~
~~30~~	~~BWR/ PWR~~	~~Concrete; cementitious material Piping, piping components, and piping elements exposed to Raw Water~~	~~Changes in material properties~~ ~~due to aggressive chemical attack~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-250~~	~~N/A~~
	~~BWR/ PWR~~	~~Fiberglass, HDPE Piping, piping components, and piping elements exposed to Raw water (internal)~~	~~Cracking, blistering, change in color~~ ~~due to water absorption~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-238~~ ~~VII.C1.AP-239~~	~~N/A~~ ~~N/A~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~**ID**~~	~~**Type**~~	~~**Component**~~	~~**Aging Effect/ Mechanism**~~	~~**Aging Management Programs**~~	~~**Further Evaluation Recommended**~~	~~**Rev2 Item**~~	~~**Rev1 Item**~~
~~31~~	~~BWR/ PWR~~	~~Concrete; cementitious material Piping, piping components, and piping elements exposed to Raw Water~~	~~Cracking~~ ~~due to settling~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-248~~	~~N/A~~
~~32~~	~~BWR/ PWR~~	~~Reinforced concrete, asbestos cement Piping, piping components, and piping elements exposed to Raw water~~	~~Cracking~~ ~~due to aggressive chemical attack and leaching;~~ ~~Changes in material properties~~ ~~due to aggressive chemical attack~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-155~~	~~N/A~~
	~~BWR/ PWR~~	~~Elastomer seals and components exposed to raw water~~	~~Hardening and loss of strength due to elastomer degradation; loss of material due to erosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-75~~ ~~VII.C1.AP-76~~	~~VII.C1-1(AP-75)~~ ~~VII.C1-2(AP-76)~~
~~33~~	~~BWR/ PWR~~	~~Concrete; cementitious material Piping, piping components, and piping elements~~	~~Loss of material~~ ~~due to abrasion, cavitation, aggressive~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-249~~	~~N/A~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~exposed to Raw Water~~	~~chemical attack, and leaching~~				
~~34~~	~~BWR/ PWR~~	~~Nickel alloy, Copper alloy Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material~~ ~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-206~~ ~~VII.C3.AP-195~~ ~~VII.C3.AP-206~~	~~VII.C1-13(AP-53)~~ ~~VII.C3-2(A-43)~~ ~~VII.C3-6(AP-53)~~
~~35~~	~~BWR/ PWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material~~ ~~due to general, pitting, crevice, and microbiologically-influenced corrosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.H2.AP-193~~	~~VII.H2-11(AP-45)~~
~~36~~	~~BWR/ PWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material~~ ~~due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-196~~	~~VII.C1-9(A-44)~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~**ID**~~	~~**Type**~~	~~**Component**~~	~~**Aging Effect/ Mechanism**~~	~~**Aging Management Programs**~~	~~**Further Evaluation Recommended**~~	~~**Rev2 Item**~~	~~**Rev1 Item**~~
~~37~~	~~BWR/ PWR~~	~~Steel (with coating or lining) Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; lining/coating degradation~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-194~~ ~~VII.C3.AP-194~~ ~~VII.H2.AP-194~~	~~VII.C1-19(A-38)~~ ~~VII.C3-10(A-38)~~ ~~VII.H2-22(A-38)~~
~~38~~	~~BWR/ PWR~~	~~Copper alloy, Steel Heat exchanger components exposed to Raw water~~	~~Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.AP-179~~ ~~VII.C1.AP-183~~	~~VII.C1-3(A-65)~~ ~~VII.C1-5(A-64)~~
~~39~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material due to pitting and crevice corrosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C3.A-53~~	~~VII.C3-7(A-53)~~
~~40~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components,~~	~~Loss of material~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.A-54~~	~~VII.C1-15(A-54)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~and piping elements exposed to Raw water~~	~~due to pitting and crevice corrosion; fouling that leads to corrosion~~				
~~41~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material~~ ~~due to pitting, crevice, and microbiologically-influenced corrosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.H2.AP-55~~	~~VII.H2-18(AP-55)~~
~~42~~	~~BWR/ PWR~~	~~Copper alloy, Titanium, Stainless steel Heat exchanger tubes exposed to Raw water~~	~~Reduction of heat transfer~~ ~~due to fouling~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VII.C1.A-72~~ ~~VII.C1.AP-153~~ ~~VII.C1.AP-187~~ ~~VII.C3.AP-187~~ ~~VII.G.AP-187~~ ~~VII.H2.AP-187~~	~~VII.C1-6(A-72)~~ ~~N/A~~ ~~VII.C1-7(AP-61)~~ ~~VII.C3-1(AP-61)~~ ~~VII.G-7(AP-61)~~ ~~VII.H2-6(AP-61)~~
~~43~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Closed-~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.C2.AP-186~~ ~~VII.E3.AP-186~~ ~~VII.E4.AP-186~~	~~VII.C2-11(AP-60)~~ ~~VII.E3-13(AP-60)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~cycle cooling water >60°C (>140°F)~~					~~VII.E4-11(AP-60)~~
~~44~~	~~BWR/ PWR~~	~~Stainless steel; steel with stainless steel cladding Heat exchanger components exposed to Closed-cycle cooling water >60°C (>140°F)~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.E3.AP-192~~	~~VII.E3-2(A-68)~~
~~45~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements; tanks exposed to Closed-cycle cooling water~~	~~Loss of material~~ ~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.C2.AP-202~~ ~~VII.F1.AP-202~~ ~~VII.F2.AP-202~~ ~~VII.F3.AP-202~~ ~~VII.F4.AP-202~~ ~~VII.H2.AP-202~~	~~VII.C2-14(A-25)~~ ~~VII.F1-20(A-25)~~ ~~VII.F2-18(A-25)~~ ~~VII.F3-20(A-25)~~ ~~VII.F4-16(A-25)~~ ~~VII.H2-23(A-25)~~
~~46~~	~~BWR/ PWR~~	~~Steel, Copper alloy Heat exchanger components, Piping, piping components, and piping elements~~	~~Loss of material~~ ~~due to general, pitting, crevice,~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.A3.AP-189~~ ~~VII.A3.AP-199~~ ~~VII.A4.AP-189~~	~~VII.A3-3(A-63)~~ ~~VII.A3-5(AP-12)~~ ~~VII.A4-3(A-63)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~exposed to Closed-cycle cooling water~~	~~and galvanic corrosion~~			~~VII.A4.AP-199~~ ~~VII.C2.AP-189~~ ~~VII.C2.AP-199~~ ~~VII.E1.AP-189~~ ~~VII.E1.AP-199~~ ~~VII.E1.AP-203~~ ~~VII.E3.AP-189~~ ~~VII.E3.AP-199~~ ~~VII.E4.AP-189~~ ~~VII.E4.AP-199~~ ~~VII.F1.AP-189~~ ~~VII.F1.AP-199~~ ~~VII.F1.AP-203~~ ~~VII.F2.AP-189~~ ~~VII.F2.AP-199~~ ~~VII.F3.AP-189~~ ~~VII.F3.AP-199~~ ~~VII.F3.AP-203~~	~~VII.A4-6(AP-12)~~ ~~VII.C2-1(A-63)~~ ~~VII.C2-4(AP-12)~~ ~~VII.E1-6(A-63)~~ ~~VII.E1-11(AP-12)~~ ~~VII.E1-2(AP-34)~~ ~~VII.E3-4(A-63)~~ ~~VII.E3-8(AP-12)~~ ~~VII.E4-2(A-63)~~ ~~VII.E4-5(AP-12)~~ ~~VII.F1-11(A-63)~~ ~~VII.F1-15(AP-12)~~ ~~VII.F1-8(AP-34)~~ ~~VII.F2-9(A-63)~~ ~~VII.F2-13(AP-12)~~ ~~VII.F3-11(A-63)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
						~~VII.F4.AP-189~~ ~~VII.F4.AP-199~~ ~~VII.H1.AP-199~~ ~~VII.H2.AP-199~~	~~VII.F3-15(AP-12)~~ ~~VII.F3-8(AP-34)~~ ~~VII.F4-8(A-63)~~ ~~VII.F4-11(AP-12)~~ ~~VII.H1-2(AP-12)~~ ~~VII.H2-8(AP-12)~~
~~47~~	~~BWR~~	~~Stainless steel; steel with stainless steel cladding Heat exchanger components exposed to Closed-cycle cooling water~~	~~Loss of material~~ ~~due to microbiologically-influenced corrosion~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.E3.AP-191~~ ~~VII.E4.AP-191~~	~~VII.E3-1(A-67)~~ ~~VII.E4-1(A-67)~~
~~48~~	~~BWR/ PWR~~	~~Aluminum Piping, piping components, and piping elements exposed to Closed-cycle cooling water~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.C2.AP-254~~ ~~VII.H2.AP-255~~	~~N/A~~ ~~N/A~~
~~49~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements~~	~~Loss of material~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.C2.A-52~~	~~VII.C2-10(A-52)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~exposed to Closed-cycle cooling water~~	~~due to pitting and crevice corrosion~~				
~~50~~	~~BWR/ PWR~~	~~Stainless steel, Copper Alloy, Steel Heat exchanger tubes exposed to Closed-cycle cooling water~~	~~Reduction of heat transfer~~ ~~due to fouling~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VII.C2.AP-188~~ ~~VII.C2.AP-205~~ ~~VII.E3.AP-188~~ ~~VII.E4.AP-188~~ ~~VII.F1.AP-204~~ ~~VII.F1.AP-205~~ ~~VII.F2.AP-204~~ ~~VII.F2.AP-205~~ ~~VII.F3.AP-204~~ ~~VII.F3.AP-205~~ ~~VII.F4.AP-204~~	~~VII.C2-3(AP-63)~~ ~~VII.C2-2(AP-80)~~ ~~VII.E3-5(AP-63)~~ ~~VII.E4-3(AP-63)~~ ~~VII.F1-13(AP-77)~~ ~~VII.F1-12(AP-80)~~ ~~VII.F2-11(AP-77)~~ ~~VII.F2-10(AP-80)~~ ~~VII.F3-13(AP-77)~~ ~~VII.F3-12(AP-80)~~ ~~VII.F4-9(AP-77)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~51~~	~~BWR/ PWR~~	~~Boraflex Spent fuel storage racks: neutron-absorbing sheets (PWR), Spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to Treated borated water, Treated water~~	~~Reduction of neutron-absorbing capacity~~ ~~due to boraflex degradation~~	~~Chapter XI.M22, "Boraflex Monitoring"~~	~~No~~	~~VII.A2.A-86~~ ~~VII.A2.A-87~~	~~VII.A2-4(A-86)~~ ~~VII.A2-2(A-87)~~
~~52~~	~~BWR/ PWR~~	~~Steel Cranes: rails and structural girders exposed to Air – indoor, uncontrolled (External)~~	~~Loss of material~~ ~~due to general corrosion~~	~~Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"~~	~~No~~	~~VII.B.A-07~~	~~VII.B-3(A-07)~~
~~53~~	~~BWR/ PWR~~	~~Steel Cranes - rails exposed to Air – indoor, uncontrolled (External)~~	~~Loss of material~~ ~~due to wear~~	~~Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"~~	~~No~~	~~VII.B.A-05~~	~~VII.B-1(A-05)~~
~~54~~	~~BWR/ PWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Condensation~~	~~Loss of material~~ ~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M24, "Compressed Air Monitoring"~~	~~No~~	~~VII.D.AP-240~~	~~N/A~~
~~55~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements: compressed air~~	~~Loss of material~~	~~Chapter XI.M24, "Compressed Air Monitoring"~~	~~No~~	~~VII.D.A-26~~	~~VII.D-2(A-26)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~system exposed to Condensation (Internal)~~	~~due to general and pitting corrosion~~				
~~56~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Condensation (Internal)~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M24, “Compressed Air Monitoring”~~	~~No~~	~~VII.D.AP-81~~	~~VII.D-4(AP-81)~~
~~57~~	~~BWR/ PWR~~	~~Elastomers Fire barrier penetration seals exposed to Air - indoor, uncontrolled, Air – outdoor~~	~~Increased hardness; shrinkage; loss of strength~~ ~~due to weathering~~	~~Chapter XI.M26, "Fire Protection"~~	~~No~~	~~VII.G.A-19~~ ~~VII.G.A-20~~	~~VII.G-1(A-19)~~ ~~VII.G-2(A-20)~~
~~58~~	~~BWR/ PWR~~	~~Steel Halon/carbon dioxide fire suppression system piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)~~	~~Loss of material~~ ~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M26, "Fire Protection"~~	~~No~~	~~VII.G.AP-150~~	~~N/A~~
~~59~~	~~BWR/ PWR~~	~~Steel Fire rated doors exposed to Air -~~	~~Loss of material~~ ~~due to wear~~	~~Chapter XI.M26, "Fire Protection"~~	~~No~~	~~VII.G.A-21~~ ~~VII.G.A-22~~	~~VII.G-3(A-21)~~ ~~VII.G-4(A-22)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~indoor, uncontrolled, Air – outdoor~~					
~~60~~	~~BWR/ PWR~~	~~Reinforced concrete Structural fire barriers: walls, ceilings and floors exposed to Air - indoor, uncontrolled~~	~~Concrete cracking and spalling~~ ~~due to aggressive chemical attack, and reaction with aggregates~~	~~Chapter XI.M26, "Fire Protection," and~~ ~~Chapter XI.S6, "Structures Monitoring"~~	~~No~~	~~VII.G.A-90~~	~~VII.G-28(A-90)~~
~~61~~	~~BWR/ PWR~~	~~Reinforced concrete Structural fire barriers: walls, ceilings and floors exposed to Air – outdoor~~	~~Cracking, loss of material~~ ~~due to freeze-thaw, aggressive chemical attack, and reaction with aggregates~~	~~Chapter XI.M26, "Fire Protection," and~~ ~~Chapter XI.S6, "Structures Monitoring"~~	~~No~~	~~VII.G.A-92~~	~~VII.G-30(A-92)~~
~~62~~	~~BWR/ PWR~~	~~Reinforced concrete Structural fire barriers: walls, ceilings and floors exposed to Air - indoor, uncontrolled, Air – outdoor~~	~~Loss of material~~ ~~due to corrosion of embedded steel~~	~~Chapter XI.M26, "Fire Protection," and~~ ~~Chapter XI.S6, "Structures Monitoring"~~	~~No~~	~~VII.G.A-91~~ ~~VII.G.A-93~~	~~VII.G-29(A-91)~~ ~~VII.G-31(A-93)~~
~~63~~	~~BWR/ PWR~~	~~Steel Fire Hydrants exposed to Air – outdoor~~	~~Loss of material~~	~~Chapter XI.M27, "Fire Water System"~~	~~No~~	~~VII.G.AP-149~~	~~N/A~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
			~~due to general, pitting, and crevice corrosion~~				
~~64~~	~~BWR/ PWR~~	~~Steel, Copper alloy Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion~~	~~Chapter XI.M27, "Fire Water System"~~	~~No~~	~~VII.G.A-33~~ ~~VII.G.AP-197~~	~~VII.G-24(A-33)~~ ~~VII.G-12(A-45)~~
~~65~~	~~BWR/ PWR~~	~~Aluminum Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material due to pitting and crevice corrosion~~	~~Chapter XI.M27, "Fire Water System"~~	~~No~~	~~VII.G.AP-180~~	~~VII.G-8(AP-83)~~
~~66~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Raw water~~	~~Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion~~	~~Chapter XI.M27, "Fire Water System"~~	~~No~~	~~VII.G.A-55~~	~~VII.G-19(A-55)~~
~~67~~	~~BWR/ PWR~~	~~Steel Tanks exposed to Air – outdoor (External)~~	~~Loss of material~~	~~Chapter XI.M29, "Aboveground Metallic Tanks"~~	~~No~~	~~VII.H1.A-95~~	~~VII.H1-11(A-95)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
			~~due to general, pitting, and crevice corrosion~~				
~~68~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements exposed to Fuel oil~~	~~Loss of material~~ ~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M30, "Fuel Oil Chemistry", and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.G.AP-234~~	~~VII.G-21(A-28)~~
~~69~~	~~BWR/ PWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Fuel oil~~	~~Loss of material~~ ~~due to general, pitting, crevice, and microbiologically-influenced corrosion~~	~~Chapter XI.M30, "Fuel Oil Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.G.AP-132~~ ~~VII.H1.AP-132~~ ~~VII.H2.AP-132~~	~~VII.G-10(AP-44)~~ ~~VII.H1-3(AP-44)~~ ~~VII.H2-9(AP-44)~~
~~70~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements; tanks exposed to Fuel oil~~	~~Loss of material~~ ~~due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion~~	~~Chapter XI.M30, "Fuel Oil Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.H1.AP-105~~ ~~VII.H2.AP-105~~	~~VII.H1-10(A-30)~~ ~~VII.H2-24(A-30)~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~71~~	~~BWR/ PWR~~	~~Stainless steel, Aluminum Piping, piping components, and piping elements exposed to Fuel oil~~	~~Loss of material~~ ~~due to pitting, crevice, and microbiologically-influenced corrosion~~	~~Chapter XI.M30, "Fuel Oil Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.G.AP-136~~ ~~VII.H1.AP-129~~ ~~VII.H1.AP-136~~ ~~VII.H2.AP-129~~ ~~VII.H2.AP-136~~	~~VII.G-17(AP-54)~~ ~~VII.H1-1(AP-35)~~ ~~VII.H1-6(AP-54)~~ ~~VII.H2-7(AP-35)~~ ~~VII.H2-16(AP-54)~~
~~72~~	~~BWR/ PWR~~	~~Gray cast iron, Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements, Heat exchanger components exposed to Treated water, Closed-cycle cooling water, Soil, Raw water~~	~~Loss of material~~ ~~due to selective leaching~~	~~Chapter XI.M33, "Selective Leaching"~~	~~No~~	~~VII.A3.AP-31~~ ~~VII.A3.AP-43~~ ~~VII.A4.AP-31~~ ~~VII.A4.AP-32~~ ~~VII.A4.AP-43~~ ~~VII.C1.A-02~~ ~~VII.C1.A-47~~ ~~VII.C1.A-51~~ ~~VII.C1.A-66~~ ~~VII.C2.A-50~~ ~~VII.C2.AP-31~~	~~VII.A3-7(AP-31)~~ ~~VII.A3-6(AP-43)~~ ~~VII.A4-10(AP-31)~~ ~~VII.A4-9(AP-32)~~ ~~VII.A4-8(AP-43)~~ ~~VII.C1-12(A-02)~~ ~~VII.C1-10(A-47)~~ ~~VII.C1-11(A-51)~~ ~~VII.C1-4(A-66)~~ ~~VII.C2-8(A-50)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
						~~VII.C2.AP-32~~ ~~VII.C2.AP-43~~ ~~VII.C3.A-02~~ ~~VII.C3.A-47~~ ~~VII.C3.A-51~~ ~~VII.E1.AP-31~~ ~~VII.E1.AP-43~~ ~~VII.E1.AP-65~~ ~~VII.E3.AP-31~~ ~~VII.E3.AP-32~~ ~~VII.E3.AP-43~~ ~~VII.E4.AP-31~~ ~~VII.E4.AP-32~~ ~~VII.E4.AP-43~~ ~~VII.F1.AP-31~~ ~~VII.F1.AP-43~~ ~~VII.F1.AP-65~~ ~~VII.F2.AP-31~~	~~VII.C2-9(AP-31)~~ ~~VII.C2-7(AP-32)~~ ~~VII.C2-6(AP-43)~~ ~~VII.C3-5(A-02)~~ ~~VII.C3-3(A-47)~~ ~~VII.C3-4(A-51)~~ ~~VII.E1-14(AP-31)~~ ~~VII.E1-13(AP-43)~~ ~~VII.E1-3(AP-65)~~ ~~VII.E3-12(AP-31)~~ ~~VII.E3-11(AP-32)~~ ~~VII.E3-10(AP-43)~~ ~~VII.E4-10(AP-31)~~ ~~VII.E4-9(AP-32)~~ ~~VII.E4-8(AP-43)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
						~~VII.F2.AP-43~~ ~~VII.F3.A-50~~ ~~VII.F3.AP-43~~ ~~VII.F3.AP-65~~ ~~VII.F4.AP-31~~ ~~VII.F4.AP-43~~ ~~VII.G.A-02~~ ~~VII.G.A-47~~ ~~VII.G.A-51~~ ~~VII.G.AP-31~~ ~~VII.H1.A-02~~ ~~VII.H1.AP-43~~ ~~VII.H2.A-02~~ ~~VII.H2.A-47~~ ~~VII.H2.A-51~~ ~~VII.H2.AP-43~~	~~VII.F1-18(AP-31)~~ ~~VII.F1-17(AP-43)~~ ~~VII.F1-9(AP-65)~~ ~~VII.F2-16(AP-31)~~ ~~VII.F2-15(AP-43)~~ ~~VII.F3-18(A-50)~~ ~~VII.F3-17(AP-43)~~ ~~VII.F3-9(AP-65)~~ ~~VII.F4-14(AP-31)~~ ~~VII.F4-13(AP-43)~~ ~~VII.G-15(A-02)~~ ~~VII.G-13(A-47)~~ ~~VII.G-14(A-51)~~ ~~VII.G-16(AP-31)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
							~~VII.H1-5(A-02)~~ ~~VII.H1-4(AP-43)~~ ~~VII.H2-15(A-02)~~ ~~VII.H2-13(A-47)~~ ~~VII.H2-14(A-51)~~ ~~VII.H2-12(AP-43)~~
~~73~~	~~BWR/ PWR~~	~~Concrete; cementitious material Piping, piping components, and piping elements exposed to Air - outdoor~~	~~Changes in material properties~~ ~~due to aggressive chemical attack~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.C1.AP-253~~	~~N/A~~
~~74~~	~~BWR/ PWR~~	~~Concrete; cementitious material Piping, piping components, and piping elements exposed to Air - outdoor~~	~~Cracking~~ ~~due to settling~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.C1.AP-251~~	~~N/A~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~75~~	~~BWR/ PWR~~	~~Reinforced concrete, asbestos cement Piping, piping components, and piping elements exposed to Air – outdoor~~	~~Cracking~~ ~~due to aggressive chemical attack and leaching;~~ ~~Changes in material properties~~ ~~due to aggressive chemical attack~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.C1.AP-156~~	~~N/A~~
~~76~~	~~BWR/ PWR~~	~~Elastomers Elastomer: seals and components exposed to Air – indoor, uncontrolled (Internal/External)~~	~~Hardening and loss of strength~~ ~~due to elastomer degradation~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.F1.AP-102~~ ~~VII.F2.AP-102~~ ~~VII.F3.AP-102~~ ~~VII.F4.AP-102~~	~~VII.F1-7(A-17)~~ ~~VII.F2-7(A-17)~~ ~~VII.F3-7(A-17)~~ ~~VII.F4-6(A-17)~~
~~77~~	~~BWR/ PWR~~	~~Concrete; cementitious material Piping, piping components, and piping elements exposed to Air - outdoor~~	~~Loss of material~~ ~~due to abrasion, cavitation, aggressive chemical attack, and leaching~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.C1.AP-252~~	~~N/A~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~**ID**~~	~~**Type**~~	~~**Component**~~	~~**Aging Effect/ Mechanism**~~	~~**Aging Management Programs**~~	~~**Further Evaluation Recommended**~~	~~**Rev2 Item**~~	~~**Rev1 Item**~~
~~78~~	~~BWR/ PWR~~	~~Steel Piping and components (External surfaces), Ducting and components (External surfaces), Ducting; closure bolting exposed to Air – indoor, uncontrolled (External), Air – indoor, uncontrolled (External), Air – outdoor (External), Condensation (External)~~	~~Loss of material due to general corrosion~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.D.A-80~~ ~~VII.F1.A-10~~ ~~VII.F1.A-105~~ ~~VII.F2.A-10~~ ~~VII.F2.A-105~~ ~~VII.F3.A-10~~ ~~VII.F3.A-105~~ ~~VII.F4.A-10~~ ~~VII.F4.A-105~~ ~~VII.I.A-105~~ ~~VII.I.A-77~~ ~~VII.I.A-78~~ ~~VII.I.A-81~~	~~VII.D-3(A-80)~~ ~~VII.F1-2(A-10)~~ ~~VII.F1-4(A-105)~~ ~~VII.F2-2(A-10)~~ ~~VII.F2-4(A-105)~~ ~~VII.F3-2(A-10)~~ ~~VII.F3-4(A-105)~~ ~~VII.F4-1(A-10)~~ ~~VII.F4-3(A-105)~~ ~~VII.I-7(A-105)~~ ~~VII.I-8(A-77)~~ ~~VII.I-9(A-78)~~ ~~VII.I-11(A-81)~~
~~79~~	~~BWR/ PWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Condensation (External)~~	~~Loss of material due to general, pitting, and crevice corrosion~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.F1.AP-109~~ ~~VII.F2.AP-109~~ ~~VII.F3.AP-109~~ ~~VII.F4.AP-109~~	~~VII.F1-16(A-46)~~ ~~VII.F2-14(A-46)~~ ~~VII.F3-16(A-46)~~ ~~VII.F4-12(A-46)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~80~~	~~BWR/ PWR~~	~~Steel Heat exchanger components, Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Air – outdoor (External)~~	~~Loss of material~~ ~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.F1.AP-41~~ ~~VII.F2.AP-41~~ ~~VII.F3.AP-41~~ ~~VII.F4.AP-41~~ ~~VII.G.AP-40~~ ~~VII.G.AP-41~~ ~~VII.H1.A-24~~ ~~VII.H2.AP-40~~ ~~VII.H2.AP-41~~	~~VII.F1-10(AP-41)~~ ~~VII.F2-8(AP-41)~~ ~~VII.F3-10(AP-41)~~ ~~VII.F4-7(AP-41)~~ ~~VII.G-6(AP-40)~~ ~~VII.G-5(AP-41)~~ ~~VII.H1-8(A-24)~~ ~~VII.H2-4(AP-40)~~ ~~VII.H2-3(AP-41)~~
~~81~~	~~BWR/ PWR~~	~~Copper alloy, Aluminum Piping, piping components, and piping elements exposed to Air – outdoor (External), Air - outdoor~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.I.AP-159~~ ~~VII.I.AP-256~~	~~N/A~~ ~~N/A~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~82~~	~~BWR/ PWR~~	~~Elastomers Elastomer: seals and components exposed to Air – indoor, uncontrolled (External)~~	~~Loss of material~~ ~~due to wear~~	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~	~~No~~	~~VII.F1.AP-113~~ ~~VII.F2.AP-113~~ ~~VII.F3.AP-113~~ ~~VII.F4.AP-113~~	~~VII.F1-5(A-73)~~ ~~VII.F2-5(A-73)~~ ~~VII.F3-5(A-73)~~ ~~VII.F4-4(A-73)~~
~~83~~	~~BWR/ PWR~~	~~Stainless steel Diesel engine exhaust piping, piping components, and piping elements exposed to Diesel exhaust~~	~~Cracking~~ ~~due to stress corrosion cracking~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.H2.AP-128~~	~~VII.H2-1(AP-33)~~
~~85~~	~~BWR/ PWR~~	~~Elastomers Elastomer seals and components exposed to Closed-cycle cooling water~~	~~Hardening and loss of strength~~ ~~due to elastomer degradation~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.C2.AP-259~~	~~N/A~~
~~86~~	~~BWR/ PWR~~	~~Elastomers Elastomers, linings, Elastomer: seals and components exposed to Treated borated water, Treated water, Raw water~~	~~Hardening and loss of strength~~ ~~due to elastomer degradation~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.A3.AP-100~~ ~~VII.A4.AP-101~~	~~VII.A3-1(A-15)~~ ~~VII.A4-1(A-16)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~88~~	~~BWR/ PWR~~	~~Steel; stainless steel Piping, piping components, and piping elements, Piping, piping components, and piping elements, diesel engine exhaust exposed to Raw water (potable), Diesel exhaust~~	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.E5.AP-270~~ ~~VII.H2.AP-104~~	~~N/A~~ ~~VII.H2-2(A-27)~~
~~89~~	~~BWR/ PWR~~	~~Steel, Copper alloy Piping, piping components, and piping elements exposed to Moist air or condensation (Internal)~~	~~Loss of material due to general, pitting, and crevice corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.G.A-23~~ ~~VII.G.AP-143~~ ~~VII.H2.A-23~~	~~VII.G-23(A-23)~~ ~~VII.G-9(AP-78)~~ ~~VII.H2-21(A-23)~~
~~90~~	~~BWR/ PWR~~	~~Steel Ducting and components (Internal surfaces) exposed to Condensation (Internal)~~	~~Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically-influenced corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.F1.A-08~~ ~~VII.F2.A-08~~ ~~VII.F3.A-08~~ ~~VII.F4.A-08~~	~~VII.F1-3(A-08)~~ ~~VII.F2-3(A-08)~~ ~~VII.F3-3(A-08)~~ ~~VII.F4-2(A-08)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~91~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements; tanks exposed to Waste Water~~	~~Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.E5.AP-281~~	~~N/A~~
~~92~~	~~BWR/ PWR~~	~~Aluminum Piping, piping components, and piping elements exposed to Condensation (Internal)~~	~~Loss of material due to pitting and crevice corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.F1.AP-142~~ ~~VII.F2.AP-142~~ ~~VII.F3.AP-142~~ ~~VII.F4.AP-142~~	~~VII.F1-14(AP-74)~~ ~~VII.F2-12(AP-74)~~ ~~VII.F3-14(AP-74)~~ ~~VII.F4-10(AP-74)~~
~~93~~	~~BWR/ PWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Raw water (potable)~~	~~Loss of material due to pitting and crevice corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.E5.AP-271~~	~~N/A~~
~~94~~	~~BWR/ PWR~~	~~Stainless steel Ducting and components exposed to Condensation~~	~~Loss of material due to pitting and crevice corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.F1.AP-99~~ ~~VII.F2.AP-99~~	~~VII.F1-1(A-09)~~ ~~VII.F2-1(A-09)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
						~~VII.F3.AP-99~~	~~VII.F3-1(A-09)~~
~~95~~	~~BWR/ PWR~~	~~Copper alloy, Stainless steel, Nickel alloy, Steel Piping, piping components, and piping elements, Heat exchanger components, Piping, piping components, and piping elements; tanks exposed to Waste water, Condensation (Internal)~~	~~Loss of material~~ ~~due to pitting, crevice, and microbiologically-influenced corrosion~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.E5.AP-272~~ ~~VII.E5.AP-273~~ ~~VII.E5.AP-274~~ ~~VII.E5.AP-275~~ ~~VII.E5.AP-276~~ ~~VII.E5.AP-278~~ ~~VII.E5.AP-279~~ ~~VII.E5.AP-280~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~
~~96~~	~~BWR/ PWR~~	~~Elastomers Elastomer: seals and components exposed to Air – indoor, uncontrolled (Internal)~~	~~Loss of material~~ ~~due to wear~~	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~	~~No~~	~~VII.F1.AP-103~~ ~~VII.F2.AP-103~~ ~~VII.F3.AP-103~~ ~~VII.F4.AP-103~~	~~VII.F1-6(A-18)~~ ~~VII.F2-6(A-18)~~ ~~VII.F3-6(A-18)~~ ~~VII.F4-5(A-18)~~
~~97~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements,~~	~~Loss of material~~	~~Chapter XI.M39, "Lubricating Oil Analysis," and~~	~~No~~	~~VII.C1.AP-127~~	~~VII.C1-17(AP-30)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~Reactor coolant pump oil collection system: tanks, Reactor coolant pump oil collection system: piping, tubing, valve bodies exposed to Lubricating oil~~	~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.M32, "One-Time Inspection"~~		~~VII.C2.AP-127~~ ~~VII.E1.AP-127~~ ~~VII.E4.AP-127~~ ~~VII.F1.AP-127~~ ~~VII.F2.AP-127~~ ~~VII.F3.AP-127~~ ~~VII.F4.AP-127~~ ~~VII.G.AP-116~~ ~~VII.G.AP-117~~ ~~VII.G.AP-127~~ ~~VII.H2.AP-127~~	~~VII.C2-13(AP-30)~~ ~~VII.E1-19(AP-30)~~ ~~VII.E4-16(AP-30)~~ ~~VII.F1-19(AP-30)~~ ~~VII.F2-17(AP-30)~~ ~~VII.F3-19(AP-30)~~ ~~VII.F4-15(AP-30)~~ ~~VII.G-27(A-82)~~ ~~VII.G-26(A-83)~~ ~~VII.G-22(AP-30)~~ ~~VII.H2-20(AP-30)~~
~~98~~	~~BWR/ PWR~~	~~Steel Heat exchanger components exposed to Lubricating oil~~	~~Loss of material~~ ~~due to general, pitting, crevice,~~	~~Chapter XI.M39, "Lubricating Oil Analysis," and~~	~~No~~	~~VII.H2.AP-131~~	~~VII.H2-5(AP-39)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
			~~and microbiologically-influenced corrosion; fouling that leads to corrosion~~	~~Chapter XI.M32, "One-Time Inspection"~~			
~~99~~	~~BWR/ PWR~~	~~Copper alloy, Aluminum Piping, piping components, and piping elements exposed to Lubricating oil~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M39, "Lubricating Oil Analysis," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.C1.AP-133~~ ~~VII.C2.AP-133~~ ~~VII.E1.AP-133~~ ~~VII.E4.AP-133~~ ~~VII.G.AP-133~~ ~~VII.H2.AP-133~~ ~~VII.H2.AP-162~~	~~VII.C1-8(AP-47)~~ ~~VII.C2-5(AP-47)~~ ~~VII.E1-12(AP-47)~~ ~~VII.E4-6(AP-47)~~ ~~VII.G-11(AP-47)~~ ~~VII.H2-10(AP-47)~~ ~~N/A~~
~~100~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Lubricating oil~~	~~Loss of material~~ ~~due to pitting, crevice, and microbiologically-influenced corrosion~~	~~Chapter XI.M39, "Lubricating Oil Analysis," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.C1.AP-138~~ ~~VII.C2.AP-138~~ ~~VII.E1.AP-138~~ ~~VII.E4.AP-138~~	~~VII.C1-14(AP-59)~~ ~~VII.C2-12(AP-59)~~ ~~VII.E1-15(AP-59)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
						~~VII.G.AP-138~~ ~~VII.H2.AP-138~~	~~VII.E4-12(AP-59)~~ ~~VII.G-18(AP-59)~~ ~~VII.H2-17(AP-59)~~
~~101~~	~~BWR/ PWR~~	~~Aluminum Heat exchanger tubes exposed to Lubricating oil~~	~~Reduction of heat transfer~~ ~~due to fouling~~	~~Chapter XI.M39, "Lubricating Oil Analysis," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~	~~No~~	~~VII.H2.AP-154~~	~~N/A~~
~~102~~	~~BWR/ PWR~~	~~Boral®; boron steel, and other materials (excluding Boraflex) Spent fuel storage racks: neutron-absorbing sheets (PWR), Spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to Treated borated water, Treated water~~	~~Reduction of neutron-absorbing capacity; change in dimensions and loss of material~~ ~~due to effects of SFP environment~~	~~Chapter XI.M40, "Monitoring of Neutron-Absorbing Materials other than Boraflex"~~	~~No~~	~~VII.A2.AP-235~~ ~~VII.A2.AP-236~~	~~VII.A2-5(A-88)~~ ~~VII.A2-3(A-89)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~103~~	~~BWR/ PWR~~	~~Reinforced concrete, asbestos cement Piping, piping components, and piping elements exposed to Soil or concrete~~	~~Cracking~~ ~~due to aggressive chemical attack and leaching;~~ ~~Changes in material properties~~ ~~due to aggressive chemical attack~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.C1.AP-157~~	~~N/A~~
~~104~~	~~BWR/ PWR~~	~~HDPE, Fiberglass Piping, piping components, and piping elements exposed to Soil or concrete~~	~~Cracking, blistering, change in color~~ ~~due to water absorption~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.C1.AP-175~~ ~~VII.C1.AP-176~~	~~N/A~~ ~~N/A~~
~~105~~	~~BWR/ PWR~~	~~Concrete cylinder piping, Asbestos cement pipe Piping, piping components, and piping elements exposed to Soil or concrete~~	~~Cracking, spalling, corrosion of rebar~~ ~~due to exposure of rebar~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.C1.AP-177~~ ~~VII.C1.AP-178~~ ~~VII.C1.AP-237~~	~~N/A~~ ~~N/A~~ ~~N/A~~
~~106~~	~~BWR/ PWR~~	~~Steel (with coating or wrapping) Piping, piping components, and piping elements~~	~~Loss of material~~ ~~due to general, pitting, crevice, and~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.C1.AP-198~~ ~~VII.C3.AP-198~~	~~VII.C1-18(A-01)~~ ~~VII.C3-9(A-01)~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
		~~exposed to Soil or concrete~~	~~microbiologically-influenced corrosion~~			~~VII.G.AP-198~~ ~~VII.H1.AP-198~~	~~VII.G-25(A-01)~~ ~~VII.H1-9(A-01)~~
~~107~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Soil or concrete~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.C1.AP-137~~ ~~VII.C3.AP-137~~ ~~VII.G.AP-137~~ ~~VII.H1.AP-137~~ ~~VII.H2.AP-137~~	~~VII.C1-16(AP-56)~~ ~~VII.C3-8(AP-56)~~ ~~VII.G-20(AP-56)~~ ~~VII.H1-7(AP-56)~~ ~~VII.H2-19(AP-56)~~
~~108~~	~~BWR/ PWR~~	~~Titanium, Super austenitic, Aluminum, Copper Alloy, Stainless Steel Piping, piping components, and piping elements, Bolting exposed to Soil or concrete~~	~~Loss of material~~ ~~due to pitting and crevice corrosion~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.C1.AP-171~~ ~~VII.C1.AP-172~~ ~~VII.C1.AP-173~~ ~~VII.C1.AP-174~~ ~~VII.I.AP-243~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~109~~	~~BWR/ PWR~~	~~Steel Bolting exposed to Soil or concrete~~	~~Loss of material due to general, pitting and crevice corrosion~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.I.AP-241~~	~~N/A~~
	~~BWR/ PWR~~	~~Underground Aluminum, Copper Alloy, Stainless Steel and Steel Piping, piping components, and piping elements~~	~~Loss of material due to general (steel only), pitting and crevice corrosion~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~	~~No~~	~~VII.I.AP-284~~	~~N/A~~
~~110~~	~~BWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Treated water >60°C (>140°F)~~	~~Cracking due to stress corrosion cracking~~	~~Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"~~	~~No~~	~~VII.E4.A-61~~	~~VII.E4-15(A-61)~~
~~111~~	~~BWR/ PWR~~	~~Steel Structural steel exposed to Air – indoor, uncontrolled (External)~~	~~Loss of material due to general, pitting, and crevice corrosion~~	~~Chapter XI.S6, "Structures Monitoring"~~	~~No~~	~~VII.A1.A-94~~	~~VII.A1-1(A-94)~~
~~112~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements exposed to Concrete~~	~~None~~	~~None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate~~	~~No, if conditions are met.~~	~~VII.J.AP-282~~	~~VII.J-21(AP-3)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
				~~air entrainment) as cited in NUREG-1557, and~~ ~~2) plant OE indicates no degradation of the concrete~~			
~~113~~	~~BWR/ PWR~~	~~Aluminum Piping, piping components, and piping elements exposed to Air – dry (Internal/External), Air – indoor, uncontrolled (Internal/External), Air – indoor, controlled (External), Gas~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-134~~ ~~VII.J.AP-135~~ ~~VII.J.AP-36~~ ~~VII.J.AP-37~~	~~N/A~~ ~~N/A~~ ~~VII.J-1(AP-36)~~ ~~VII.J-2(AP-37)~~
~~114~~	~~BWR/ PWR~~	~~Copper alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (Internal/External), Air – dry, Gas~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-144~~ ~~VII.J.AP-8~~ ~~VII.J.AP-9~~	~~N/A~~ ~~VII.J-3(AP-8)~~ ~~VII.J-4(AP-9)~~
~~115~~	~~PWR~~	~~Copper alloy (≤15% Zn and ≤8% Al) Piping, piping components, and piping elements exposed to Air with borated water leakage~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-11~~	~~VII.J-5(AP-11)~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~

~~ID~~	~~Type~~	~~Component~~	~~Aging Effect/ Mechanism~~	~~Aging Management Programs~~	~~Further Evaluation Recommended~~	~~Rev2 Item~~	~~Rev1 Item~~
~~116~~	~~BWR/ PWR~~	~~Galvanized steel Piping, piping components, and piping elements exposed to Air - indoor, uncontrolled~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-13~~	~~VII.J-6(AP-13)~~
~~117~~	~~BWR/ PWR~~	~~Glass Piping elements exposed to Air – indoor, uncontrolled (External), Lubricating oil, Closed-cycle cooling water, Air – outdoor, Fuel oil, Raw water, Treated water, Treated borated water, Air with borated water leakage, Condensation (Internal/External) Gas~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-14~~ ~~VII.J.AP-15~~ ~~VII.J.AP-166~~ ~~VII.J.AP-167~~ ~~VII.J.AP-48~~ ~~VII.J.AP-49~~ ~~VII.J.AP-50~~ ~~VII.J.AP-51~~ ~~VII.J.AP-52~~ ~~VII.J.AP-96~~ ~~VII.J.AP-97~~ ~~VII.J.AP-98~~	~~VII.J-8(AP-14)~~ ~~VII.J-10(AP-15)~~ ~~N/A~~ ~~N/A~~ ~~VII.J-7(AP-48)~~ ~~VII.J-9(AP-49)~~ ~~VII.J-11(AP-50)~~ ~~VII.J-13(AP-51)~~ ~~VII.J-12(AP-52)~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

~~Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report~~							
~~**ID**~~	~~**Type**~~	~~**Component**~~	~~**Aging Effect/ Mechanism**~~	~~**Aging Management Programs**~~	~~**Further Evaluation Recommended**~~	~~**Rev2 Item**~~	~~**Rev1 Item**~~
~~118~~	~~BWR/ PWR~~	~~Nickel alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-16~~	~~VII.J-14(AP-16)~~
~~119~~	~~BWR/ PWR~~	~~Nickel alloy, PVC, Glass Piping, piping components, and piping elements exposed to Air with borated water leakage, Air – indoor, uncontrolled, Condensation (Internal), Waste Water~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-260~~ ~~VII.J.AP-268~~ ~~VII.J.AP-269~~ ~~VII.J.AP-277~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~
~~120~~	~~BWR/ PWR~~	~~Stainless steel Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (Internal/External), Air – indoor, uncontrolled (External), Air with borated water leakage, Concrete, Air – dry, Gas~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-123~~ ~~VII.J.AP-17~~ ~~VII.J.AP-18~~ ~~VII.J.AP-19~~ ~~VII.J.AP-20~~ ~~VII.J.AP-22~~	~~N/A~~ ~~VII.J-15(AP-17)~~ ~~VII.J-16(AP-18)~~ ~~VII.J-17(AP-19)~~ ~~VII.J-18(AP-20)~~ ~~VII.J-19(AP-22)~~

~~**Table 3.3-1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report**~~

~~**ID**~~	~~**Type**~~	~~**Component**~~	~~**Aging Effect/ Mechanism**~~	~~**Aging Management Programs**~~	~~**Further Evaluation Recommended**~~	~~**Rev2 Item**~~	~~**Rev1 Item**~~
~~121~~	~~BWR/ PWR~~	~~Steel Piping, piping components, and piping elements exposed to Air – indoor, controlled (External), Air – dry, Gas~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-2~~ ~~VII.J.AP-4~~ ~~VII.J.AP-6~~	~~VII.J-20(AP-2)~~ ~~VII.J-22(AP-4)~~ ~~VII.J-23(AP-6)~~
~~122~~	~~BWR/ PWR~~	~~Titanium Heat exchanger components, Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled or Air – outdoor~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.J.AP-151~~ ~~VII.J.AP-160~~	~~N/A~~ ~~N/A~~
~~123~~	~~BWR/ PWR~~	~~Titanium (ASTM Grades 1,2, 7, 11, or 12 that contains > 5% aluminum or more than 0.20% oxygen or any amount of tin) Heat exchanger components other than tubes, Piping, piping components, and piping elements exposed to Raw water~~	~~None~~	~~None~~	~~NA - No AEM or AMP~~	~~VII.C1.AP-152~~ ~~VII.C1.AP-161~~	~~N/A~~ ~~N/A~~

~~Table 3.3-2 Aging Management Programs Recommended for Aging Management of Auxiliary Systems~~	
~~GALL Report Chapter/AMP~~	~~Program Name~~
~~Chapter XI.M1~~	~~ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD~~
~~Chapter XI.M2~~	~~Water Chemistry~~
~~Chapter XI.M7~~	~~BWR Stress Corrosion Cracking~~
~~Chapter XI.M10~~	~~Boric Acid Corrosion~~
~~Chapter XI.M18~~	~~Bolting Integrity~~
~~Chapter XI.M20~~	~~Open-Cycle Cooling Water System~~
~~Chapter XI.M21A~~	~~Closed Treated Water Systems~~
~~Chapter XI.M22~~	~~Boraflex Monitoring~~
~~Chapter XI.M23~~	~~Inspection of Overhead Heavy and Light Loads (Related to Refueling) Handling Systems~~
~~Chapter XI.M24~~	~~Compressed Air Monitoring~~
~~Chapter XI.M25~~	~~BWR Reactor Cleanup System~~
~~Chapter XI.M26~~	~~Fire Protection~~
~~Chapter XI.M27~~	~~Fire Water System~~
~~Chapter XI.M29~~	~~Aboveground Metallic Tanks~~
~~Chapter XI.M30~~	~~Fuel Oil Chemistry~~
~~Chapter XI.M32~~	~~One-Time Inspection~~
~~Chapter XI.M33~~	~~Selective Leaching~~
~~Chapter XI.M36~~	~~External Surfaces Monitoring of Mechanical Components~~
~~Chapter XI.M38~~	~~Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components~~
~~Chapter XI.M39~~	~~Lubricating Oil Analysis~~
~~Chapter XI.M40~~	~~Monitoring of Neutron-Absorbing Materials Other than Boraflex~~
~~Chapter XI.M41~~	~~Buried and Underground Piping and Tanks~~
~~Chapter XI.S6~~	~~Structures Monitoring~~
~~Appendix for GALL~~	~~Quality Assurance for Aging Management Programs~~
~~SRP-LR Appendix A~~	~~Plant-specific AMP~~

~~1. 3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEM~~

~~Review Responsibilities~~

~~**Primary** - Branch assigned responsibility by PM as described in Section 3.0 of this SRP-LR.~~

~~1.1.6 3.4.1 Areas of Review~~

~~This section addresses the aging management review (AMR) and the associated aging management program (AMP) of the steam and power conversion system. 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 FSAR, consistent with the “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants” (NUREG-0800). The steam and power conversion systems contained in this review plan section are generally consistent with those contained in NUREG-0800 except for the condenser circulating water and the condensate storage systems. For older plants, the location of applicable information is plant-specific because an older plant’s FSAR may have predated NUREG-0800.~~

~~Typical steam and power conversion systems that are subject to an AMR for license renewal are steam turbine, main steam, extraction steam, feedwater, condensate, steam generator blowdown, and auxiliary feedwater. This review plan section also includes structures and components in nonsafety-related systems that are not connected to safety-related SSCs but have a spatial relationship such that their failure could adversely impact the performance of a safety-related SSC intended function. Examples of such nonsafety-related systems may be extraction steam, plant heating steam/auxiliary boilers and hot water heating systems.~~

~~The aging management for the steam generator is reviewed following the guidance in Section 3.1 of this SRP-LR. The aging management for portions of the BWR main steam and main feedwater systems, extending from the reactor vessel to the outermost containment isolation valve, is reviewed separately following the guidance in Section 3.1 of this SRP-LR.~~

~~The responsible review organization is to review the following LRA AMR and AMP items assigned to it, per SRP-LR Section 3.0:~~

~~AMRs~~

- ~~AMR results consistent with the GALL Report~~
- ~~AMR results for which further evaluation is recommended by the GALL Report~~
- ~~AMR results not consistent with or not addressed in the GALL Report~~

~~AMPs~~

- ~~Consistent with GALL Report AMPs~~
- ~~Plant-specific AMPs~~

~~FSAR Supplement~~

- ~~The responsible review organization is to review the FSAR Supplement associated with each assigned AMP.~~

~~1.1.7 3.4.2 Acceptance Criteria~~

~~The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the NRC's regulations in 10 CFR 54.21.~~

~~*1.1.7.1 3.4.2.1 AMR Results Consistent with the GALL Report*~~

~~The AMR and the AMPs applicable to the steam and power conversion system are described and evaluated in Chapter VIII of NUREG-1801 (GALL Report).~~

~~The applicant's LRA should provide sufficient information so that the NRC reviewer is able to confirm that the specific LRA AMR item and the associated LRA AMP are consistent with the cited GALL Report AMR item. The reviewer should then confirm that the LRA AMR item is consistent with the GALL Report AMR item to which it is compared.~~

~~When the applicant is crediting a different aging management program than recommended in the GALL Report, the reviewer should confirm that the alternate aging management program is valid to use for aging management and will be capable of managing the effects of aging as adequately as the aging management program recommended by the GALL Report.~~

~~*1.1.7.2 3.4.2.2 AMR Results for Which Further Evaluation is Recommended by the GALL Report*~~

~~The basic acceptance criteria, defined in Subsection 3.4.2.1, need to be applied first for all of the AMRs and AMPs reviewed as part of this section. In addition, if the GALL Report AMR item to which the LRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.4-1, comparing the "Further Evaluation Recommended" and the "Rev2 Item" columns, for the AMR items that reference the following subsections. The 2005 AMR item counterpart is provided in the "Rev1 Item" column.~~

~~*1.1.7.2.1 3.4.2.2.1 Cumulative Fatigue Damage*~~

~~Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-LR. The related GALL Report items invoked by the subsection are VIII.D1.S-11, VIII.D2.S-11, VIII.G.S-11, VIII.B1.S-08, VIII.B2.S-08.~~

~~*1.1.7.2.2 3.4.2.2.2 Cracking due to Stress Corrosion Cracking (SCC)*~~

~~Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The possibility of cracking also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. Cracking is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine~~

~~or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above.~~

~~GALL AMP XI.M36, “External Surfaces Monitoring,” is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external chloride stress corrosion cracking is not expected. The GALL Report recommends further evaluation to determine whether an adequate aging management program is used to manage this aging effect based on the environmental conditions applicable to the plant and ASME Code Section XI requirements applicable to the components.~~

~~1.1.7.2.3 3.4.2.2.3 Loss of Material due to Pitting and Crevice Corrosion~~

~~Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The possibility of pitting and crevice corrosion also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents. Pitting and crevice corrosion is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above.~~

~~GALL AMP XI.M36, “External Surfaces Monitoring,” is an acceptable method to manage the aging effect. The applicant may demonstrate that this item is not applicable by describing the outdoor air environment present at the plant and demonstrating that external pitting or crevice corrosion is not expected. The GALL Report recommends further evaluation to determine whether an adequate aging management program is used to manage this aging effect based on the environmental conditions applicable to the plant and ASME Code Section XI requirements Quality Assurance for Aging Management of Nonsafety-Related Components.~~

~~3.4.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components~~

~~Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2, of this SRP-LR).~~

~~1.1.7.3 3.4.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report~~

~~Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).~~

~~1.1.7.4 3.4.2.4 Aging Management Programs~~

~~For those AMPs that will be used for aging management and are based on the program elements of an AMP in the GALL Report, the NRC reviewer performs an audit of aging management programs credited in the LRA to confirm consistency with the GALL AMPs identified in the GALL Report, Chapters X and XI.~~

~~If the applicant identifies an exception to any of the program elements of the cited GALL Report AMP, the LRA AMP should include a basis demonstrating how the criteria of 10 CFR 54.21(a)(3) would still be met. The NRC reviewer should then confirm that the LRA AMP with all exceptions would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the LRA AMP, the reviewer identifies a difference between the LRA AMP and the GALL Report AMP that should have been identified as an exception to the GALL Report AMP, the difference should be reviewed and properly dispositioned. The reviewer should document the disposition of all LRA-defined exceptions and staff-identified differences.~~

~~The LRA should identify any enhancements that are needed to permit an existing LRA AMP to be declared consistent with the GALL Report AMP to which the LRA AMP is compared. The reviewer is to confirm both that the enhancement, when implemented, would allow the existing LRA AMP to be consistent with the GALL Report AMP and also that the applicant has a commitment in the FSAR Supplement to implement the enhancement prior to the period of extended operation. The reviewer should document the disposition of all enhancements.~~

~~If the applicant chooses to use a plant-specific program that is not a GALL AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of Branch Technical Position RLSB-1 (Appendix A.1.2.3 of this SRP-LR).~~

~~*1.1.7.5 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 be sufficiently comprehensive that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects will be managed during the period of extended operation. The description should also contain any future aging management activities, including enhancements and commitments, to be completed before the period of extended operation. Table 3.0-1 of this SRP-LR provides examples of the type of information to be included in the FSAR Supplement. Table 3.4-2 lists the programs that are applicable for this SRP-LR subsection.~~

3.4.3 Review Procedures

For each area of review, the following review procedures discussed below are to be followed.

3.4.3.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The applicant may reference the GALL-SLR Report in its ~~LRA~~SLRA, as appropriate, and demonstrate that the AMRs and AMPs at its facility are consistent with those reviewed and approved in the GALL-SLR Report. The reviewer should not conduct a re-review of the substance of the matters described in the GALL-SLR Report. If the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL-SLR Report, the reviewer should find acceptable the applicant's reference to the GALL-SLR Report in its ~~LRA.~~SLRA. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the ~~applicant has stated that the~~ applicable aging effects ~~and~~have been addressed based on the NRC staff's review of industry and plant-specific operating experience ~~have been reviewed by the applicant and are evaluated in the GALL Report~~.

Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL-SLR Report. Performance of this review requires the reviewer to confirm that the applicant has identified those aging effects for the steam and power conversion system components that are contained in the GALL-SLR Report as applicable to its plant.

3.4.3.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic review procedures defined in Subsection 3.4.3.1 need to be applied first for all of the AMRs and AMPs provided in this section. In addition, if the GALL-SLR Report AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that “further evaluation is recommended,” then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.4-1 for the~~ Rev 2~~ item references for the following subsections.

3.4.3.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The reviewer reviews the evaluation of this TLAA separately following the guidance in Section 4.3 of this SRP-~~LR~~SLR.

3.4.3.2.2 Cracking Due to Stress Corrosion Cracking

The GALL-SLR Report recommends further evaluation to manage cracking due to ~~stress corrosion cracking~~SCC of ~~stainless steel~~ SS and aluminum piping, piping components, ~~piping elements,~~ and tanks exposed to outdoor air environments containing sufficient halides (~~primarily~~e.g., chlorides) and in which condensation ~~or deliquescence~~ is possible. The possibility of cracking also extends to components exposed to air which has recently been introduced into buildings~~,~~ (i.e., components near intake vents~~.~~.)

~~The~~ If the applicant claims that neither the environment nor composition of insulation will result in stress corrosion cracking, the reviewer should ~~determine whether an adequate program is used to manage the aging effect based on the applicable environmental conditions and ASME Code requirements. Cracking is only known to occur in environments containing~~ evaluate the applicant’s data to verify that sufficient halides ~~(primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are~~ will not ~~limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile~~be present on the surface of ~~a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above. GALL AMP XI.M36, “External Surfaces Monitoring,” is an acceptable method to manage the aging effect.~~

~~*1.1.7.5.1 3.4.3.2.3 Loss of Material due to Pitting and Crevice Corrosion*~~

~~The GALL Report recommends further evaluation to manage loss of material due to pitting and crevice corrosion of stainless steel piping~~the SS piping, piping components, ~~piping elements,~~

~~and tanks exposed to outdoor air environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. The possibility of pitting and crevice corrosion also extends to components exposed to air which has recently been introduced into buildings, i.e., components near intake vents.~~

or tanks. If the applicant elects to manage stress corrosion cracking, the reviewer should determine whether an adequate program is ~~used~~credited to manage the aging effect based on the applicable environmental conditions~~ and ASME Code requirements. Pitting and crevice corrosion is only known to occur in environments containing sufficient halides (primarily chlorides) and in which condensation or deliquescence is possible. Condensation or deliquescence should generally be assumed to be possible. Applicable outdoor air environments (and associated indoor air environments) include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. This item is applicable for the environments described above. GALL AMP XI.M36, "External Surfaces Monitoring," is an acceptable method to manage the aging effect~~.

3.4.3.2.3 Loss of Material Due to Pitting and Crevice Corrosion

The GALL-SLR Report recommends further evaluation to manage loss of material due to pitting and crevice corrosion of SS piping, piping components, and tanks exposed to outdoor air or any air environment when the component is insulated where the presence of sufficient halides (e.g., chlorides) and moisture is possible. The possibility of pitting and crevice corrosion also extends to indoor components located in close proximity to sources of outdoor air (e.g., components near intake vents).

If the applicant claims that neither the environment nor composition of the insulation will result in loss of material due to pitting and crevice corrosion, the reviewer should evaluate the applicant's data to verify that sufficient halides will not be present on the surface of the SS piping, piping components, or tanks. If the applicant elects to manage loss of material due to pitting or crevice corrosion, the reviewer should determine whether an adequate program is credited to manage the aging effect based on the applicable environmental conditions.

3.4.3.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's ~~aging management programs~~AMPs for ~~license renewal~~SLR should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an ~~aging management review for license renewal.~~AMP for SLR. Nevertheless, the applicant has the option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address these program elements. If the applicant chooses this option, the reviewer ~~verifies~~confirms that the applicant has documented such a commitment in the FSAR Supplement. An example description is under "Quality Assurance" in Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems." If the applicant chooses alternative means, the branch responsible for ~~quality assurance~~ QA should be requested to review the applicant's proposal on a case-by-case basis.

3.4.3.2.5 Ongoing Review of Operating Experience

The applicant’s AMPs should contain the element of operating experience. The reviewer verifies that the applicant has appropriate programs or processes for the ongoing review of both plant-specific and industry operating experience concerning age-related degradation and aging management. Such reviews are used to ensure that the AMPs are effective to manage the aging effects for which they are created. The AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Additional information is in Appendix A.4, “Operating Experience for Aging Management Programs.”

In addition, the reviewer confirms that the applicant has provided an appropriate summary description of these activities in the FSAR supplement. The GALL-SLR Report provides examples of the type of information to be included in the FSAR Supplement

3~~AMR~~.4.3.2.6 Loss of Material Due to Recurring Internal Corrosion

The GALL-SLR Report recommends further evaluation to manage recurring internal corrosion aging effects. The reviewer conducts an independent review of plant-specific operating experience to determine whether the plant is currently experiencing recurring internal corrosion. The scope of this further evaluation AMR item includes recurring aging effects in which the plant-specific operating experience review reveals repetitive occurrences (e.g., one per refueling outage that has occurred: (a) in any three or more cycles for a 10-year operating experience search, or (b) in any two or more cycles for a 5-year operating experience search) of aging effects with the same aging mechanism as a result of which the component either did not meet plant-specific acceptance criteria or experienced a reduction in wall thickness greater than 50 percent (regardless of the minimum wall thickness).

The reviewer should evaluate plant-specific operating experience examples to determine if the chosen AMP should be augmented. For example, during a 10-year search of plant specific operating experience, two instances of 360 degree 30 percent wall loss occurred at copper alloy to steel joints. Neither the significance of the aging effect nor the frequency of occurrence of aging effect threshold has been exceeded. Nevertheless, the operating experience should be evaluated to determine if the AMP that is proposed to manage the aging effect is sufficient (e.g., method of inspection, frequency of inspection, number of inspections) to provide reasonable assurance that the CLB intended functions of the component will be met throughout the subsequent period of extended operation. Likewise, the GALL-SLR Report AMR items associated with the new further evaluation items only cite raw water and waste water environments because operating experience indicates that these are the predominant environments associated with recurring internal corrosion; however, if the search of plant-specific operating experience reveals recurring internal corrosion in other water environments (e.g., treated water), the aging effect should be addressed in a similar manner.

3.4.3.2.7 Cracking Due to Stress Corrosion Cracking in Aluminum Alloys

The GALL-SLR Report recommends the further evaluation of aluminum components (i.e., piping, piping components, and tanks) exposed to atmospheric air or aqueous solutions that contain halides to manage cracking due to SCC. The reviewer must first determine if the aging effect of cracking due to SCC is applicable and requires aging management. The aging effect of cracking is to be considered applicable unless it is demonstrated that one of the two acceptance criteria are met by demonstrating that an aggressive environment is not present or the specific material is not susceptible, as discussed in Section 3.4.2.2.7. Additionally, guidance is also provided on the review of the third condition necessary for SCC to occur, a sustained tensile stress. Each of three conditions is evaluated based on the review procedures below.

Susceptible Material: If the material used to fabricate the component being evaluated is not susceptible to SCC then the aging effect of cracking due to SCC is not applicable and does not require aging management. When determining if an aluminum alloy is susceptible to SCC the reviewer is to verify the material's (a) alloy composition, (b) condition or temper, and (c) product form. Additionally, if the material was produced using a process specifically developed to provide a SCC resistant microstructure then the reviewer will consider the effects of this processing in the review. Once the material information has been established the reviewer is to evaluate the technical justification used to substantiate that the material is not susceptible to SCC when exposed to an aggressive environment and sustained tensile stress. The reviewer will evaluate all documentation and references used by the applicant as part of a technical justification.

Aggressive Environment: If the environment that an aluminum alloy is exposed to is not aggressive, such as dry gas, controlled indoor air, or treated water, then the aging effect of cracking due to SCC is not applicable and does not require aging management. The environments cited in the AMR line items in the GALL-SLR Report that reference this further evaluation are considered to be aggressive and potentially containing halide concentrations that facilitate SCC of aluminum alloys. The reviewer is to verify that components are not also periodically exposed to nontypical environments that would be categorized as aggressive, such as outdoor air which has recently been introduced into a building and the leakage/seepage of untreated aqueous solutions into a building or underground vault. Using information provided by the applicant, the reviewer will also evaluate the chemical composition of applicable encapsulating materials (e.g., concrete, insulation) for halides.

If a barrier coating is employed to effectively isolate the aluminum alloy from an aggressive environment then the aging effect of cracking due to SCC is not applicable and does not require aging management. The reviewer is to verify that the barrier coating is impermeable to the plant-specific aqueous solutions and atmospheric air that the coating is intended to protect the alloy from being exposed to. If operating experience is cited as a technical justification for the effectiveness of a barrier coating the reviewer is to verify that the applicant has a program to manage loss of coating integrity equivalent to the GALL-SLR Report AMP XI.M42.

Sustained Tensile Stress: If the sustained tensile stress being experienced by a component is below the SCC threshold value then cracking will not occur and the aging effect is not applicable. Many aluminum alloys do not have a true SCC threshold stress, although a practical SCC threshold value can be determined based on the material, service environment, and duration of intended function. The basis for the SCC threshold value is to be evaluated to determine its applicability. The magnitude of the maximum tensile service stress (applied and residual) experienced by the component is to be evaluated to verify that the stress levels are bounded by the SCC threshold value.

The information necessary to eliminate the aging effect of SCC based on the sustained service stress is often not readily available. The SCC threshold stress level is dependent on both the alloy (e.g., chemical composition, processing history, and microstructure) and service environment. Furthermore, the magnitude and state of the residual stress sustained by a component is typically not fully characterized. The reviewer must determine the adequacy of both the SCC threshold value being used by the applicant and the magnitude of the tensile stress being experienced by the component. The evaluation of the SCC threshold value includes the verification that the (a) test method used to establish the threshold value is standardized and recognized by the industry, (b) data are statistically significant or conservative, and (c) data are for a relevant alloy, temper, product form, and environment. The evaluation of the tensile stress being experienced by the component includes the verification that the stress analysis accounts for (e) all applied and residual stresses and (f) stress raiser that can initiate SCC cracks, such as corrosion pits and fabrication defects.

Documentation that may assist the reviewer in determining if the aging effect of cracking due to SCC is applicable and requires aging management include (a) component drawings, (b) applicable Codes or specifications used in the design, fabrication, and installation of the component, (c) material-specific material certification data and lot release data, and (d) maintenance records and plant-specific operating experience.

If it is determined that the aging effect of cracking due to SCC is applicable the reviewer is to evaluate the applicants proposed AMP to ensure that the effects of aging on components are adequately managed so that their intended functions will be maintained consistent with the CLB for the subsequent period of extended operation. The GALL-SLR Report AMP XI.M29, “Aboveground Metallic Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in tanks. The GALL-SLR Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” is an acceptable method to manage cracking of aluminum due to SCC in piping, and piping components. The GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in piping and tanks which are buried or underground. The GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components” is an acceptable method to manage cracking of aluminum due to SCC in components that are not included in other AMPs.

3.4.3.2.8 Loss of Material Due to General, Crevice or Pitting Corrosion and Microbiologically-Induced Corrosion and Cracking Due to Stress Corrosion Cracking

The GALL-SLR Report recommends that for steel piping and piping components exposed to concrete, if the following conditions are met, loss of material is not considered to be an applicable aging effect for steel: (a) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557; (b) plant-specific operating experience indicates no degradation of the concrete that could lead to penetration of water to the metal surface; and (c) the piping is not potentially exposed to groundwater. For SS piping and piping components, loss of material and cracking due to SCC are not considered to be applicable aging effects as long as the piping is not potentially exposed to groundwater. Where these conditions are not met, loss of material due to general (steel only), crevice or pitting corrosion and microbiologically-induced corrosion and cracking due to SCC (SS only) are identified as applicable aging effects. GALL-SLR Report AMP XI.M41, “Buried and Underground Piping and Tanks,” is an acceptable method to manage these aging effects.

The reviewer verifies that the concrete was specified to meet ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG–1557. The reviewer should evaluate plant-specific operating experience to determine whether concrete degradation sufficient to allow water intrusion has occurred.

3.4.3.2.9 Loss of Material Due to Pitting and Crevice Corrosion and Microbiologically-Induced Corrosion in Components Exposed to Treated Water, Treated Borated Water, or Sodium Pentaborate Solution

The GALL-SLR Report recommends that loss of material due to crevice corrosion can occur in steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if oxygen levels are greater than 100 ppb. In addition, loss of material due to pitting can occur if oxygen levels are greater than 100 ppb, halides or sulfates levels are greater than 150 ppb, and stagnant flow conditions exist. Loss of material due to microbiologically-induced corrosion can occur with steel with SS cladding, SS, and nickel alloy piping, piping components, heat exchanger components, spent fuel storage racks, tanks, and PWR heat exchanger components exposed to treated water, treated borated water, or sodium pentaborate solution if the pH is less than 10.5 and temperature is less than 99 °C [210 °F].

The reviewer verifies the applicant's chemistry control parameters to determine whether GALL-SLR Report AMP XI.M2, "Water Chemistry," and a one-time inspection program is implemented (e.g., GALL-SLR Report AMP XI.M32, "One-Time Inspection") or GALL-SLR Report AMP XI.M2, "Water Chemistry," and a periodic inspection program is implemented (e.g., GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components") to manage loss of material.

3.4.3.2.10 Loss of Material Due to Pitting and Crevice Corrosion in Aluminum Alloys

The GALL-SLR Report recommends a further evaluation to determine whether an AMP is needed to manage the aging effect of loss of material due to pitting and crevice corrosion of aluminum piping, piping components, and tanks exposed to an air environment. If the applicant claims that a search of 10 years of plant-specific did not reveal any instances of loss of material due to pitting and crevice corrosion exposed to air environments, the staff conducts an independent review of plant-specific operating experience during the AMP audit.

An alternative strategy to demonstrating that pitting and crevice corrosion is not applicable is to isolate the aluminum alloy from the air environment using a barrier. Acceptable barriers include anodization and tightly adhering coatings that have been demonstrated to be impermeable to aqueous solutions and atmospheric air that contain halides. If a barrier coating is credited for isolating an aluminum alloy from a potentially aggressive environment then the barrier coating is evaluated to verify that it is impermeable to the plant-specific environment. GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," is an acceptable method to manage the integrity of internal and external barrier coatings.

The reviewer is to verify that the SLRA cites the use of GALL-SLR AMP XI.M32, "One-Time Inspection," for all aluminum piping, piping components, and tanks exposed to air environments. Alternatively, if the applicant states that it will utilize a strategy of isolating the aluminum components from the environment, verify that the aluminum components are coated and GALL-SLR AMP XI.M42 has been cited to manage loss of coating integrity.

3.4.3.3 Aging Management Review Results Not Consistent With or Not Addressed ~~in the GALL~~ in the Generic Aging Lessons Learned for Subsequent License Renewal Report

The reviewer should confirm that the applicant, in its ~~LRA~~SLRA, has identified applicable aging effects, listed the appropriate combination of materials and environments, and has credited AMPs that will adequately manage the aging effects. The AMP credited by the applicant could be an AMP that is described and evaluated in the GALL-SLR Report or a plant-specific program. Review procedures are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

3.4.3.4 Aging Management Programs

The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL ~~Report or a plant-specific program. Review procedures are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).~~

~~*1.1.7.6 3.4.3.4 Aging Management Programs*~~

~~The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL Report.~~-SLR Report. If the applicant commits to an enhancement to make its ~~LRA~~SLRA AMP consistent with a GALL-SLR Report AMP, then the reviewer is to confirm that this enhancement, when implemented, will make the ~~LRA~~SLRA AMP consistent with the GALL-SLR Report AMP. If the applicant identifies, in the ~~LRA~~SLRA AMP, an exception to any of the program elements of the GALL-SLR Report AMP, the reviewer is to confirm that the ~~LRA~~SLRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3). If the reviewer identifies a difference, not identified by the ~~LRA~~SLRA, between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP with which the ~~LRA~~SLRA claims to be consistent, the reviewer should confirm that the ~~LRA~~SLRA AMP with this difference satisfies 10 CFR 54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions, or differences. The AMPs evaluated in the GALL-SLR Report pertinent to the steam and power conversion system are summarized in Table 3.4-1 of this SRP-~~LR.~~SLR. The "~~Rev 2~~GALL-SLR Item" ~~(for 2010) and "Rev1 Item" (for 2005 counterpart) columns identify~~ column identifies the AMR item numbers in the GALL-SLR Report, Chapter VIII, presenting detailed information summarized by this row.

Table 3.4-1 of this SRP-~~LR~~SLR may identify a plant-specific ~~aging management program.~~AMP. If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1.2.3 of this SRP~~-LR~~-SLR Report).

3.4.3.5 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer confirms that the applicant has provided in the FSAR supplement information equivalent to that in ~~Table 3.0-1~~GALL-SLR for aging management of the steam and power conversion systems. Table 3.4-2 lists the AMPs that are applicable for this SRP-~~LR~~SLR subsection. The reviewer also confirms that the applicant has provided information for Subsection 3.4.3.3, "AMR Results Not Consistent with or Not Addressed in the GALL-SLR Report," equivalent to that in Table 3.0-1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR Supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR Supplement without prior NRC approval, provided that the applicant evaluates each such change and finds it acceptable pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.

As noted in Table 3.0-1, the applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should confirm that the applicant has identified and committed in the ~~LRA~~SLRA to any future aging management activities, including enhancements and commitments, to be completed before entering the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

3.4.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of this section, then an evaluation finding similar to the following text should be included in the NRC staff's safety evaluation report:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has demonstrated that the aging effects associated with the steam and power conversion system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).
>
> The NRC staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the steam and power conversion system, as required by 10 CFR 54.21(d).

3.4.5 Implementation

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

3.4.6 References

1. NRC. NUREG~~-~~–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants~~,"~~." Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March 2007.

~~2. NUREG-1801, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

~~3.~~2. NEI. NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 ~~—~~The License Renewal Rule~~,"~~." Revision 6. Washington, DC: Nuclear Energy Institute~~, Revision 6~~. 1995.

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~1~~M	~~BWR/PWR~~ 1	~~Steel Piping, piping components, and piping elements exposed to Steam or Treated water~~BWR/PWR	~~Cumulative fatigue damage~~ ~~due to fatigue~~Steel piping, piping components exposed to steam, treated water	~~Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).~~Cumulative fatigue damage due to fatigue	~~Yes,~~ TLAA ~~(See subsection 3.~~, SRP-SLR Section 4.~~2.2.1)~~3 "Metal Fatigue"	~~VIII.B1.S-08~~ ~~VIII.B2.S-08~~ ~~VIII.D1.S-11~~ ~~VIII.D2.S-11~~ ~~VIII.G.S-11~~ Yes (SRP-SLR Section 3.4.2.2.1)	VIII.B1~~-10(~~.S-08~~)~~ VIII.B2~~-5(~~.S-08~~)~~ VIII.D1~~-7(~~.S-11~~)~~ VIII.D2~~-6(~~.S-11~~)~~ VIII.G~~-37(~~.S-11~~)~~
~~2~~M	~~BWR/PWR~~ 2	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor~~BWR/PWR	~~Cracking~~ ~~due to stress corrosion cracking~~Stainless steel piping, piping components exposed to air – outdoor	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Cracking due to stress corrosion cracking	~~Yes, environmental conditions need to be evaluated (See subsection 3.4.2.2.2)~~AMP XI.M36, "External Surfaces Monitoring of	~~VIII.A.SP-118~~ ~~VIII.B1.SP-118~~ ~~VIII.B2.SP-118~~ ~~VIII.C.SP-118~~ ~~VIII.D1.SP-118~~ ~~VIII.D2.SP-118~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
					Mechanical Components"	~~VIII.E.SP-118~~ ~~VIII.F.SP-118~~ ~~VIII.G.SP-118~~ Yes (SRP-SLR Section 3.4.2.2.2)	~~N/A~~ ~~N/A~~ ~~N/A~~ VIII.A.SP-118 VIII.B1.SP-118 VIII.B2.SP-118 VIII.C.SP-118 VIII.D1.SP-118 VIII.D2.SP-118 VIII.E.SP-118 VIII.F.SP-118 VIII.G.SP-118
3M	~~BWR/PWR~~ 3	~~Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel piping, piping	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Loss of	~~Yes, environmental conditions need to be evaluated (See subsection 3.4.2.2.3)~~AMP	~~VIII.A.SP-127~~ ~~VIII.B1.SP-127~~ ~~VIII.B2.SP-127~~	~~N/A~~ ~~N/A~~ ~~N/A~~

Table 3.4-1~~.~~ Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			components exposed to air – outdoor	material due to pitting, crevice corrosion	XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~VIII.C.SP-127~~ ~~VIII.D1.SP-127~~ ~~VIII.D2.SP-127~~ ~~VIII.E.SP-127~~ ~~VIII.F.SP-127~~ ~~VIII.G.SP-127~~ Yes (SRP-SLR Section 3.4.2.2.3)	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ VIII.A.SP-127 VIII.B1.SP-127 VIII.B2.SP-127 VIII.C.SP-127 VIII.D1.SP-127 VIII.D2.SP-127 VIII.E.SP-127 VIII.F.SP-127 VIII.G.SP-127

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
4	~~PWR~~4	~~Steel External surfaces, Bolting exposed to Air with borated water leakage~~PWR	~~Loss of material due to boric acid corrosion~~Steel external surfaces, bolting exposed to air with borated water leakage	~~Chapter XI.M10, "Boric Acid Corrosion"~~Loss of material due to boric acid corrosion	~~No~~AMP XI.M10, "Boric Acid Corrosion"	~~VIII.H.S-30~~ ~~VIII.H.S-40~~ No	VIII.H~~-9(~~.S-30~~)~~ VIII.H~~-2(~~.S-40~~)~~
~~5~~M	~~BWR/PWR~~5	~~Steel Piping, piping components, and piping elements exposed to Steam, Treated water~~BWR/PWR	~~Wall thinning due to flow-accelerated corrosion~~Steel piping, piping components exposed to steam, treated water	~~Chapter XI.M17, "Flow-Accelerated Corrosion"~~Wall thinning due to flow-accelerated corrosion	~~No~~AMP XI.M17, "Flow-Accelerated Corrosion"	~~VIII.A.S-15~~ ~~VIII.B1.S-15~~ ~~VIII.B2.S-15~~ ~~VIII.C.S-15~~ ~~VIII.D1.S-16~~ ~~VIII.D2.S-16~~ ~~VIII.E.S-16~~ ~~VIII.F.S-16~~ ~~VIII.G.S-16~~ No	VIII.A~~-17(~~.S-15~~)~~ VIII.B1~~-9(~~.S-15~~)~~ VIII.B2~~-4(~~.S-15~~)~~ VIII.C~~-5(~~.S-15~~)~~ VIII.D1~~-9(~~.S-16~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.D2~~-8(~~.S-16~~)~~ VIII.E~~-35(~~.S-16~~)~~ VIII.F~~-26(~~.S-16~~)~~ VIII.G~~-39(~~.S-16~~)~~
~~6~~M	~~BWR/PWR~~ 6	~~Steel, Stainless Steel Bolting exposed to Soil~~BWR/PWR	~~Loss of preload~~Steel, stainless steel bolting exposed to soil	~~Chapter XI.M18, "Bolting Integrity "~~Loss of preload due to thermal effects, gasket creep, or self-loosening	~~No~~AMP XI.M18, "Bolting Integrity"	~~VIII.H.SP-142~~ ~~VIII.H.SP-144~~ No	~~N/A~~ ~~N/A~~ VIII.H.SP-142 VIII.H.SP-144
~~7~~	~~BWR/PWR~~ 7	~~High-strength steel Closure bolting exposed to Air with steam or water leakage~~BWR/PWR	~~Cracking due to cyclic loading, stress corrosion cracking~~High-strength steel closure bolting	~~Chapter XI.M18, "Bolting Integrity"~~Cracking due to cyclic loading, stress corrosion cracking	~~No~~AMP XI.M18, "Bolting Integrity"	~~VIII.H.S-03~~ No	VIII.H~~-3(~~.S-03~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			exposed to air with steam or water leakage				
~~8~~	~~BWR/PWR~~ 8	~~Steel; stainless steel Bolting, Closure bolting exposed to Air – outdoor (External), Air – indoor, uncontrolled (External)~~BWR/PWR	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor uncontrolled (external)	~~Chapter XI.M18, "Bolting Integrity"~~Loss of material due to general (steel only), pitting, crevice corrosion	~~No~~AMP XI.M18, "Bolting Integrity"	~~VIII.H.SP-82~~ ~~VIII.H.SP-84~~ No	VIII.H~~-1(S-32)~~ .SP-82 VIII.H~~-4(S-34)~~ .SP-84
~~9~~	~~BWR/PWR~~ 9	~~Steel Closure bolting exposed to Air with steam or water leakage~~BWR/PWR	~~Loss of material due to general corrosion~~Steel closure bolting exposed to air with steam or water leakage	~~Chapter XI.M18, "Bolting Integrity"~~Loss of material due to general corrosion	~~No~~AMP XI.M18, "Bolting Integrity"	~~VIII.H.S-02~~ No	VIII.H~~-6(~~.S-02~~)~~
~~10~~M	~~BWR/PWR~~ 10	~~Copper alloy, Nickel alloy, Steel; stainless steel, Steel; stainless steel Bolting, Closure bolting exposed to Any environment, Air – outdoor (External), Air – indoor,~~	~~Loss of preload due to thermal effects, gasket creep, and self-loosening~~Copper alloy, nickel alloy, steel; stainless steel bolting, closure bolting exposed to any environment, air	~~Chapter XI.M18, "Bolting Integrity"~~Loss of preload due to thermal effects, gasket creep, or self-loosening	~~No~~AMP XI.M18, "Bolting Integrity"	~~VIII.H.SP-149~~ ~~VIII.H.SP-150~~ ~~VIII.H.SP-151~~ ~~VIII.H.SP-83~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~VIII.H-5(S-33)~~

Table 3.4-1~~.~~ Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~uncontrolled (External)~~BWR/PWR	– outdoor (external), air – indoor uncontrolled (external)				VIII.H.SP-149 VIII.H.SP-150 VIII.H.SP-151 VIII.H.SP-83
~~11~~M	~~BWR/PWR~~ 11	~~Stainless steel Piping, piping components, and piping elements, Tanks, Heat exchanger components exposed to Steam, Treated water >60°C (>140°F)~~BWR/PWR	~~Cracking due to stress corrosion cracking~~Stainless steel piping, piping components, tanks, heat exchanger components exposed to steam, treated water >60°C (>140°F)	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~VIII.A.SP-98 VIII.B1.SP-88 VIII.B1.SP-98 VIII.B2.SP-98 VIII.C.SP-88 VIII.D1.SP-88 VIII.E.SP-88 VIII.E.SP-97 VIII.F.SP-85 VIII.F.SP-88 VIII.G.SP-88~~ No	VIII.A~~-11(~~.SP-~~45)~~ 98 VIII.B1~~-5(~~.SP-~~17)~~ 88 VIII.B1~~-2(~~.SP-~~44)~~ 98 VIII.B2~~-1(~~.SP-~~45)~~ 98 VIII.C~~-2(~~.SP-~~17)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							88 VIII.D1~~-5(~~.SP-~~17)~~ 88 VIII.E~~-30(~~.SP-~~17)~~ 88 VIII.E~~-38(~~.SP-~~42)~~ 97 VIII.F~~-3(S-39)~~ .SP-85 VIII.F~~-24(~~.SP-~~17)~~ 88 VIII.G~~-33(~~.SP-~~17)~~ 88
~~12~~M	~~BWR/PWR~~ 12	~~Steel; stainless steel Tanks exposed to Treated water~~BWR/PWR	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~Steel	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time~~	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32,	~~VIII.E.SP-75~~ ~~VIII.G.SP-75~~ No	VIII.E~~-40(S-13)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			tanks exposed to treated water	~~Inspection"~~Loss of material due to general (steel only), pitting, crevice corrosion, MIC	"One-Time Inspection"		.SP-75 VIII.G-~~41(S-13)~~ .SP-75
~~13~~M	~~PWR~~13	~~Steel Piping, piping components, and piping elements exposed to Treated water~~PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping, piping components exposed to treated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~VIII.B1.SP-74~~ ~~VIII.D1.SP-74~~ ~~VIII.F.SP-74~~ ~~VIII.G.SP-74~~ No	VIII.B1-~~11(S-10)~~ .SP-74 VIII.D1-~~8(S-10)~~ .SP-74 VIII.F-~~25(S-10)~~ .SP-74 VIII.G-~~38(S-10)~~ .SP-74
~~14~~M	~~BWR/PWR~~ 14	~~Steel Piping, piping components, and piping elements, PWR heat exchanger components exposed to Steam, Treated water~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping, piping components, PWR heat exchanger components exposed to steam, treated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to general, pitting, crevice corrosion, MIC (treated water only)	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~VIII.A.SP-71~~ ~~VIII.B1.SP-71~~ ~~VIII.B2.SP-160~~ ~~VIII.B2.SP-73~~ ~~VIII.C.SP-71~~	VIII.A-~~15(S-04)~~ .SP-71 VIII.B1-~~8(S-07)~~

Table 3.4-1~~.~~ Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~VIII.C.SP-73~~ ~~VIII.D2.SP-73~~ ~~VIII.E.SP-73~~ ~~VIII.E.SP-78~~ ~~VIII.F.SP-78~~ No	.SP-71 VIII.B2~~-3(S-05)~~ .SP-160 VIII.B2~~-6(S-09)~~ .SP-73 VIII.C~~-3(S-04)~~ .SP-71 VIII.C~~-6(S-09)~~ .SP-73 VIII.D2~~-7(S-09)~~ .SP-73 VIII.E~~-33(S-09)~~ .SP-73 VIII.E~~-37(S-19)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							.SP-78 VIII.F~~-28(S-19)~~ .SP-78
~~15~~M	~~BWR/PWR~~ 15	~~Steel Heat exchanger components exposed to Treated water~~BWR/PWR	~~Loss of material due to general, pitting, crevice, and galvanic corrosion~~Steel heat exchanger components exposed to treated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~VIII.E.SP-77~~ No	VIII.E~~-7(S-18)~~ .SP-77
~~16~~M	~~BWR/PWR~~ 16	~~Copper alloy, Stainless steel, Nickel alloy, Aluminum Piping, piping components, and piping elements, Heat exchanger components and tubes, PWR heat exchanger components exposed to Treated water, Steam~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Copper alloy, aluminum piping, piping components exposed to treated water	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC (copper alloy only)	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~VIII.A.SP-101~~ ~~VIII.A.SP-155~~ ~~VIII.B1.SP-155~~ ~~VIII.B1.SP-157~~ ~~VIII.B1.SP-87~~ ~~VIII.B2.SP-155~~ ~~VIII.C.SP-87~~ ~~VIII.D1.SP-87~~	VIII.A~~-5(~~.SP-~~61)~~ ~~VIII.A-12(SP-43)~~ ~~VIII.B1-3(SP-43)~~ ~~VIII.B1-1(SP-18)~~ ~~VIII.B1-4(SP-16)~~ ~~VIII.B2-2(SP43)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~VIII.D1.SP-90~~ ~~VIII.D2.SP-87~~ ~~VIII.D2.SP-90~~ ~~VIII.E.SP-80~~ ~~VIII.E.SP-81~~ ~~VIII.E.SP-87~~ ~~VIII.E.SP-90~~ ~~VIII.F.SP-101~~ ~~VIII.F.SP-81~~ ~~VIII.F.SP-87~~ ~~VIII.F.SP-90~~ ~~VIII.G.SP-87~~ ~~VIII.G.SP-90~~ No	~~VIII.C-1(SP-16)~~ 101 VIII.D1~~-4(~~.SP-~~16)~~ ~~VIII.D1-1(SP-24)~~ 90 VIII.D2~~-4(~~.SP-~~16)~~ ~~VIII.D2-1(SP-24)~~ 90 VIII.E-~~4(S-21)~~ ~~VIII.E-36(S-22)~~ ~~VIII.E-29(~~.SP-~~16)~~

Table 3.4-1~~.~~.	**Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report**						
~~ID~~New (N), Modified (M), Deleted (D) Item	**~~Type~~ID**	**~~Component~~Type**	**~~Aging Effect/Mechanism~~Component**	**Aging ~~Management Programs~~Effect/Mechanism**	**~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA**	**~~Rev2 Item~~Further Evaluation Recommended**	**~~Rev1~~GALL-SLR Item**
							~~VIII.E-15(SP-24)~~ 90 VIII.F~~-15(~~.SP-~~61)~~ 101 VIII.F~~-27(S-22)~~ ~~VIII.F-23(~~.SP-~~16)~~ ~~VIII.F-12(SP-24)~~ 90 VIII.G~~-32(~~.SP-~~16)~~ ~~VIII.G-17(SP-24)~~ 90
~~17~~	~~PWR~~17	~~Copper alloy Heat exchanger tubes exposed to Treated water~~PWR	~~Reduction of~~Copper alloy heat ~~transfer~~	~~Chapter XI.M2, "Water Chemistry," and~~	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32,	~~VIII.F.SP-100~~ No	VIII.F~~-7(~~.SP-~~58)~~ 100

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			~~due~~exchanger tubes exposed to ~~fouling~~treated water	~~Chapter XI.M32, "One-Time Inspection"~~Reduction of heat transfer due to fouling	"One-Time Inspection"		
~~18~~	~~BWR/PWR~~ 18	~~Copper alloy, Stainless steel Heat exchanger tubes exposed to Treated water~~BWR/PWR	~~Reduction of heat transfer~~ ~~due to fouling~~Copper alloy, stainless steel heat exchanger tubes exposed to treated water	~~Chapter XI.M2, "Water Chemistry," and~~ ~~Chapter XI.M32, "One-Time Inspection"~~Reduction of heat transfer due to fouling	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	~~VIII.E.SP-100~~ ~~VIII.E.SP-96~~ ~~VIII.F.SP-96~~ ~~VIII.G.SP-100~~ No	VIII.E-~~10(~~.SP-~~58)~~ 100 VIII.E-~~13(~~.SP-~~40)~~ 96 VIII.F-~~10(~~.SP-~~40)~~ 96 VIII.G-~~10(~~.SP-~~58)~~ 100
~~19~~M	~~BWR/PWR~~ 19	~~Stainless steel, Steel Heat exchanger components exposed to Raw water~~BWR/PWR	~~Loss of material~~ ~~due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion~~Stainless steel, steel heat	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Loss of material due to general (steel only), pitting, crevice corrosion, MIC; fouling that leads to corrosion; flow	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~VIII.E.SP-117~~ ~~VIII.E.SP-146~~ ~~VIII.F.SP-146~~ ~~VIII.G.SP-117~~ ~~VIII.G.SP-146~~	VIII.E-~~3(S-26)~~ .SP-117 VIII.E-~~6(S-24)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			exchanger components exposed to raw water	blockage due to fouling		No	.SP-146 VIII.F~~-5(S-24)~~ .SP-146 VIII.F.SP-117 VIII.G~~-4(S-26)~~ .SP-117 VIII.G~~-7(S-24)~~ .SP-146
~~20~~M	~~BWR/PWR~~ 20	~~Copper alloy, Stainless steel Piping, piping components, and piping elements exposed to Raw water~~BWR/PWR	~~Loss of material due to pitting, crevice, and microbiologically-influenced corrosion~~Copper alloy, stainless steel piping, piping components exposed to raw water	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Loss of material due to general (copper alloy only), pitting, crevice corrosion, MIC; flow blockage due to fouling	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~VIII.A.SP-31~~ ~~VIII.E.SP-31~~ ~~VIII.E.SP-36~~ ~~VIII.F.SP-31~~ ~~VIII.F.SP-36~~ ~~VIII.G.SP-31~~ ~~VIII.G.SP-36~~ No	VIII.A~~-4(~~.SP-31~~)~~ VIII.E~~-18(~~.SP-31~~)~~ VIII.E~~-27(~~.SP-36~~)~~ VIII.F~~-14(~~.SP-31~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL~~-~~SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.F~~-22(~~.SP-36~~)~~ VIII.G~~-20(~~.SP-31~~)~~ VIII.G~~-30(~~.SP-36~~)~~
~~21~~D	~~PWR~~21	~~Stainless steel Heat exchanger components exposed to Raw water~~	~~Loss of material~~ ~~due to pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion~~	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~	~~No~~	~~VIII.F.SP-117~~	~~VIII.F-2(S-26)~~
~~22~~	~~BWR/PWR~~ 22	~~Stainless steel, Copper alloy, Steel Heat exchanger tubes, Heat exchanger components exposed to Raw water~~BWR/PWR	~~Reduction of heat transfer~~ ~~due to fouling~~Stainless steel, copper alloy, steel heat exchanger tubes, heat exchanger components exposed to raw water	~~Chapter XI.M20, "Open-Cycle Cooling Water System"~~Reduction of heat transfer due to fouling	~~No~~AMP XI.M20, "Open-Cycle Cooling Water System"	~~VIII.E.S-28~~ ~~VIII.E.SP-56~~ ~~VIII.F.S-28~~ ~~VIII.F.SP-56~~ ~~VIII.G.S-27~~	VIII.E~~-12(~~.S-28~~)~~ VIII.E~~-9(~~.SP-56~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~VIII.G.S-28~~ ~~VIII.G.SP-56~~ No	VIII.F~~-9(~~.S-28~~)~~ VIII.F~~-6(~~.SP-56~~)~~ VIII.G~~-16(~~.S-27~~)~~ VIII.G~~-13(~~.S-28~~)~~ VIII.G~~-9(~~.SP-56~~)~~
~~23~~M	~~BWR/PWR~~ 23	~~Stainless steel Piping, piping components, and piping elements exposed to Closed-cycle cooling water >60°C (>140°F)~~BWR/PWR	~~Cracking due to stress corrosion cracking~~Stainless steel piping, piping components exposed to closed-cycle cooling water >60°C (>140°F)	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~VIII.E.SP-54~~ ~~VIII.F.SP-54~~ ~~VIII.G.SP-54~~ No	VIII.E~~-25(~~.SP-54~~)~~ VIII.F~~-21(~~.SP-54~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.G~~-28(~~.SP-54~~)~~
~~24~~D	~~BWR/PWR~~ 24	~~Steel Heat exchanger components exposed to Closed-cycle cooling water~~	~~Loss of material due to general, pitting, crevice, and galvanic corrosion~~	~~Chapter XI.M21A, "Closed Treated Water Systems"~~	~~No~~	~~VIII.A.S-23~~	~~VIII.A-1(S-23)~~
~~25~~M	~~BWR/PWR~~ 25	~~Steel Heat exchanger components exposed to Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to general, pitting, crevice, and galvanic corrosion~~Steel heat exchanger components exposed to closed-cycle cooling water	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~VIII.E.S-23~~ ~~VIII.F.S-23~~ ~~VIII.G.S-23~~ No	VIII.A.S-23 VIII.E~~-5(~~.S-23~~)~~ VIII.F~~-4(~~.S-23~~)~~ VIII.G~~-5(~~.S-23~~)~~
~~26~~M	~~BWR/PWR~~ 26	~~Stainless steel Heat exchanger components, Piping, piping components, and piping elements exposed to Closed-~~	~~Loss of material due to pitting and crevice corrosion~~Stainless steel heat exchanger	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~VIII.E.S-25~~ ~~VIII.E.SP-39~~ ~~VIII.F.S-25~~	VIII.E~~-2(~~.S-25~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~cycle cooling water~~BWR/PWR	components, piping, piping components exposed to closed-cycle cooling water			~~VIII.F.SP-39~~ ~~VIII.G.S-25~~ ~~VIII.G.SP-39~~ No	VIII.E~~-24(~~.SP-39~~)~~ VIII.F~~-1(~~.S-25~~)~~ VIII.F~~-20(~~.SP-39~~)~~ VIII.G~~-2(~~.S-25~~)~~ VIII.G~~-27(~~.SP-39~~)~~
~~27~~M	~~BWR/PWR~~ 27	~~Copper alloy Piping, piping components, and piping elements exposed to Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to pitting, crevice, and galvanic corrosion~~Copper alloy piping, piping components exposed to closed-cycle cooling water	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~VIII.E.SP-8~~ ~~VIII.F.SP-8~~ ~~VIII.G.SP-8~~ No	VIII.E~~-16(~~.SP-8~~)~~ VIII.F~~-13(~~.SP-8~~)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.G~~-18(~~.SP-8~~)~~
~~28~~M	~~BWR/PWR~~ 28	~~Steel, Stainless steel, Copper alloy Heat exchanger components and tubes, Heat exchanger tubes exposed to Closed-cycle cooling water~~BWR/PWR	~~Reduction of heat transfer due to fouling~~Steel, stainless steel, copper alloy heat exchanger components and tubes exposed to closed-cycle cooling water	~~Chapter XI.M21A, "Closed Treated Water Systems"~~Reduction of heat transfer due to fouling	~~No~~AMP XI.M21A, "Closed Treated Water Systems"	~~VIII.A.SP-64~~ ~~VIII.E.SP-41~~ ~~VIII.E.SP-57~~ ~~VIII.E.SP-64~~ ~~VIII.F.SP-41~~ ~~VIII.F.SP-64~~ ~~VIII.G.SP-41~~ ~~VIII.G.SP-64~~ No	VIII.A~~-2(~~.SP-64~~)~~ VIII.E~~-11(~~.SP-41~~)~~ VIII.E~~-8(~~.SP-57~~)~~ VIII.E~~-14(~~.SP-64~~)~~ VIII.F~~-8(~~.SP-41~~)~~ VIII.F~~-11(~~.SP-64~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.G~~-11(~~.SP-41~~)~~ VIII.G~~-14(~~.SP-64~~)~~
~~29~~	~~BWR/PWR~~ 29	~~Steel Tanks exposed to Air – outdoor (External)~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel tanks exposed to air – outdoor (external)	~~Chapter XI.M29, "Aboveground Metallic Tanks"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M29, "Aboveground Metallic Tanks"	~~VIII.E.S-31~~ ~~VIII.G.S-31~~ No	VIII.E~~-39(~~.S-31~~)~~ VIII.G~~-40(~~.S-31~~)~~
~~30~~M	~~BWR/PWR~~ 30	~~Steel, Stainless Steel, Aluminum Tanks exposed to Soil or Concrete, Air – outdoor (External)~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete, air – outdoor, air – indoor uncontrolled, moist air, condensation (external)	~~Chapter XI.M29, "Aboveground Metallic Tanks"~~Loss of material due to general, pitting, crevice corrosion, MIC (soil environment only)	~~No~~AMP XI.M29, "Aboveground Metallic Tanks"	~~VIII.E.SP-115~~ ~~VIII.E.SP-138~~ ~~VIII.E.SP-140~~ ~~VIII.G.SP-116~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ VIII.E.SP-115 VIII.G.SP-116

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~31~~D	~~BWR/PWR~~ 31	~~Stainless steel, Aluminum Tanks exposed to Soil or Concrete~~	~~Loss of material due to pitting, and crevice corrosion~~	~~Chapter XI.M29, "Aboveground Metallic Tanks"~~	~~No~~	~~VIII.E.SP-137~~ ~~VIII.E.SP-139~~	~~N/A~~ ~~N/A~~
~~32~~M	~~BWR/PWR~~ 32	~~Gray cast iron Piping, piping components, and piping elements exposed to Soil~~BWR/PWR	~~Loss of material due to selective leaching~~Gray cast iron piping, piping components exposed to soil, ground water	~~Chapter XI.M33, "Selective Leaching"~~Loss of material due to selective leaching	~~No~~AMP XI.M33, "Selective Leaching"	~~VIII.E.SP-26~~ ~~VIII.G.SP-26~~ No	VIII.E~~-22(~~.SP-26~~)~~ VIII.G~~-25(~~.SP-26~~)~~
~~33~~M	~~BWR/PWR~~ 33	~~Gray cast iron, Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements exposed to Treated water, Raw water, Closed-cycle cooling water~~BWR/PWR	~~Loss of material due to selective leaching~~Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components exposed to treated water, raw water, closed-cycle cooling water, soil, ground water	~~Chapter XI.M33, "Selective Leaching"~~Loss of material due to selective leaching	~~No~~AMP XI.M33, "Selective Leaching"	~~VIII.A.SP-27~~ ~~VIII.A.SP-28~~ ~~VIII.A.SP-30~~ ~~VIII.E.SP-27~~ ~~VIII.E.SP-29~~ ~~VIII.E.SP-30~~ ~~VIII.E.SP-55~~ ~~VIII.F.SP-27~~ ~~VIII.F.SP-29~~	VIII.A~~-8(~~.SP-27~~)~~ VIII.A~~-7(~~.SP-28~~)~~ VIII.A~~-6(~~.SP-30~~)~~ VIII.E~~-23(SP-27)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~VIII.F.SP-30~~ ~~VIII.F.SP-55~~ ~~VIII.G.SP-27~~ ~~VIII.G.SP-28~~ ~~VIII.G.SP-29~~ ~~VIII.G.SP-30~~ ~~VIII.G.SP-55~~ No	.S-440 VIII.E~~-19(~~.SP-~~29)~~ 27 VIII.E~~-20(~~.SP-~~30)~~ 29 VIII.E~~-21(~~.SP-30 VIII.E.SP-55 ~~)~~ VIII.F~~-19(SP-27)~~ .S-440 VIII.F~~-16(~~.SP-~~29)~~ 27 VIII.F~~-17(~~.SP-~~30)~~ 29 VIII.F~~-18(~~.SP-30 VIII.F.SP-

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							55 ~~)~~ VIII.G~~-26(~~.S-440 VIII.G.SP-27 ~~)~~ ~~VIII.G-24(SP-28)~~ VIII.G~~-21(~~.SP-28 VIII.G.SP-29 ~~)~~ ~~VIII.G-22(SP-30)~~ VIII.G~~-23(~~.SP-30 VIII.G.SP-55~~)~~
~~34~~M	~~BWR/PWR~~ 34	~~Steel External surfaces exposed to Air – indoor, uncontrolled~~	~~Loss of material due to general corrosion~~Steel external	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical~~	~~No~~AMP XI.M36, "External Surfaces Monitoring of	~~VIII.H.S-29~~ ~~VIII.H.S-41~~	VIII.H~~-7(~~.S-29 ~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~(External), Air – outdoor (External), Condensation (External)~~BWR/PWR	surfaces exposed to air – indoor uncontrolled (external), air – outdoor (external), condensation (external)	~~Components"~~Loss of material due to general, pitting, crevice corrosion	Mechanical Components"	~~VIII.H.S-42~~ No	VIII.H~~-8(~~.S-41~~)~~ VIII.H~~-10(~~.S-42~~)~~
~~35~~M	~~BWR/PWR~~ 35	~~Aluminum Piping, piping components, and piping elements exposed to Air - outdoor~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Aluminum piping, piping components exposed to air – outdoor	~~Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	~~VIII.H.SP-147~~ No	~~N/A~~ VIII.H.SP-147
~~36~~M	~~PWR~~36	~~Steel Piping, piping components, and piping elements exposed to Air – outdoor (Internal)~~PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping, piping components exposed to air – outdoor (internal)	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~VIII.B1.SP-59~~ No	VIII.B1~~-6(~~.SP-59~~)~~
~~37~~M	~~PWR~~37	~~Steel Piping, piping components, and piping elements exposed to~~	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping,	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting~~	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and	~~VIII.B1.SP-60~~ ~~VIII.G.SP-60~~ No	VIII.B1~~-7(~~.SP-60~~)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL~~-~~SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~Condensation (Internal)~~PWR	piping components exposed to condensation (internal)	~~Components"~~Loss of material due to general, pitting, crevice corrosion	Ducting Components"		VIII.G~~-34(~~.SP-60~~)~~
~~38~~M	~~PWR~~38	~~Steel Piping, piping components, and piping elements exposed to Raw water~~ PWR	~~Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion~~Steel piping, piping components exposed to raw water	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads to corrosion	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~VIII.G.SP-136~~ No	VIII.G~~-36(S-12)~~ .SP-136
~~39~~M	~~BWR/PWR~~ 39	~~Stainless steel Piping, piping components, and piping elements exposed to Condensation (Internal)~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel piping, piping components exposed to condensation (internal)	~~Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Loss of material due to pitting and crevice corrosion	~~No~~AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~VIII.B1.SP-110~~ ~~VIII.B2.SP-110~~ No	~~N/A~~ ~~N/A~~ VIII.B1.SP-110 VIII.B2.SP-110
~~40~~M	~~BWR/PWR~~ 40	~~Steel Piping, piping components, and piping elements exposed to Lubricating oil~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel piping, piping components	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~VIII.A.SP-91~~ ~~VIII.D1.SP-91~~ ~~VIII.D2.SP-91~~	VIII.A~~-14(~~.SP-~~25)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			exposed to lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC		~~VIII.E.SP-91~~ ~~VIII.G.SP-91~~ No	91 VIII.D1~~-6(~~.SP-~~25)~~ 91 VIII.D2~~-5(~~.SP-~~25)~~ 91 VIII.E~~-32(~~.SP-~~25)~~ 91 VIII.G~~-35(~~.SP-~~25)~~ 91
~~41~~	~~PWR~~41	~~Steel Heat exchanger components exposed to Lubricating oil~~PWR	~~Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion~~Steel heat exchanger components exposed to lubricating oil	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~ Loss of material due to general, pitting, crevice corrosion, MIC	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~VIII.G.SP-76~~ No	VIII.G~~-6(S-17)~~ .SP-76

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL~~-~~SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~42~~M	~~PWR~~42	~~Aluminum Piping, piping components, and piping elements exposed to Lubricating oil~~PWR	~~Loss of material due to pitting and crevice corrosion~~Aluminum piping, piping components exposed to lubricating oil	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~VIII.G.SP-114~~ No	~~N/A~~ VIII.G.SP-114
~~43~~M	~~BWR/PWR~~ 43	~~Copper alloy Piping, piping components, and piping elements exposed to Lubricating oil~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Copper alloy piping, piping components exposed to lubricating oil	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~ Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~VIII.A.SP-92~~ ~~VIII.D1.SP-92~~ ~~VIII.D2.SP-92~~ ~~VIII.E.SP-92~~ ~~VIII.G.SP-92~~ No	VIII.A~~-3(~~.SP-~~32)~~ 92 VIII.D1~~-2(~~.SP-~~32)~~ 92 VIII.D2~~-2(~~.SP-~~32)~~ 92 VIII.E~~-17(~~.SP-~~32)~~ 92 VIII.G~~-19(~~.SP-~~32)~~ 92

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~44~~M	~~BWR/PWR~~ 44	~~Stainless steel Piping, piping components, and piping elements, Heat exchanger components exposed to Lubricating oil~~BWR/PWR	~~Loss of material due to pitting, crevice, and microbiologically-influenced corrosion~~Stainless steel piping, piping components, heat exchanger components exposed to lubricating oil	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~ Loss of material due to pitting, crevice corrosion, MIC	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~VIII.A.SP-95~~ ~~VIII.D1.SP-95~~ ~~VIII.D2.SP-95~~ ~~VIII.E.SP-95~~ ~~VIII.G.SP-79~~ ~~VIII.G.SP-95~~ No	VIII.A~~-9(~~.SP-~~38)~~ 95 VIII.D1~~-3(~~.SP-~~38)~~ 95 VIII.D2~~-3(~~.SP-~~38)~~ 95 VIII.E~~-26(~~.SP-~~38)~~ 95 VIII.G~~-3(S-20)~~ .SP-79 VIII.G~~-29(~~.SP-~~38)~~ 95
~~45~~	~~PWR~~45	~~Aluminum Heat exchanger components and tubes exposed to Lubricating oil~~PWR	~~Reduction of~~Aluminum heat ~~transfer~~ ~~due~~exchanger components and tubes	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time~~	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~VIII.G.SP-113~~ No	~~N/A~~ VIII.G.SP-113

Table 3.4-1.   Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			exposed to ~~fouling~~lubricating oil	~~Inspection"~~Reduction of heat transfer due to fouling			
~~46~~	~~PWR~~46	~~Stainless steel, Steel, Copper alloy Heat exchanger tubes exposed to Lubricating oil~~PWR	~~Reduction of heat transfer due to fouling~~Stainless steel, steel, copper alloy heat exchanger tubes exposed to lubricating oil	~~Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"~~ Reduction of heat transfer due to fouling	~~No~~AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection"	~~VIII.G.SP-102~~ ~~VIII.G.SP-103~~ ~~VIII.G.SP-99~~ No	VIII.G~~-12(~~.SP-~~62)~~ 102 VIII.G~~-15(~~.SP-~~63)~~ 103 VIII.G~~-8(~~.SP-~~53)~~ 99
~~47~~M	~~BWR/PWR~~ 47	~~Steel (with coating or wrapping) Piping, piping components, and piping elements; tanks exposed to Soil or Concrete~~BWR/PWR	~~Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion~~Steel (with coating or wrapping), stainless steel, nickel-alloy piping, piping components, tanks exposed to soil, concrete	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of material due to general (steel only), pitting, crevice corrosion, MIC	~~No~~AMP XI.M41, "Buried and Underground Piping and Tanks"	~~VIII.E.SP-145~~ ~~VIII.G.SP-145~~ No	VIII.E~~-1(S-01)~~ .SP-145 VIII.G~~-1(S-01)~~ .SP-145

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~48~~M	~~BWR/PWR~~ 48	~~Stainless Steel Bolting exposed to Soil~~ BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel, nickel alloy bolting exposed to soil, concrete	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of material due to pitting, crevice corrosion, MIC (soil environment only)	~~No~~AMP XI.M41, "Buried and Underground Piping and Tanks"	~~VIII.H.SP-143~~ No	~~N/A~~ VIII.H.SP-143
~~49~~M	~~BWR/PWR~~ 49	~~Stainless steel Piping, piping components, and piping elements exposed to Soil or Concrete~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Stainless steel, nickel alloy piping, piping components exposed to soil, concrete	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of material due to pitting, crevice corrosion, MIC (soil environment only)	~~No~~AMP XI.M41, "Buried and Underground Piping and Tanks"	~~VIII.E.SP-94~~ ~~VIII.G.SP-94~~ No	VIII.E~~-28(~~.SP-~~37)~~ 94 VIII.G~~-31(~~.SP-~~37)~~ 94
~~50~~M	~~BWR/PWR~~ 50	~~Steel Bolting exposed to Soil~~ BWR/PWR	~~Loss of material due to general, pitting and crevice corrosion~~Steel bolting exposed to soil, concrete	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of material due to general, pitting, crevice corrosion, MIC (soil environment only)	~~No~~AMP XI.M41, "Buried and Underground Piping and Tanks"	~~VIII.H.SP-141~~ No	~~N/A~~ VIII.H.SP-141
M	~~BWR/PWR~~ 50x	~~Underground Stainless Steel and Steel Piping, piping components, and~~	~~Loss of material due to general (steel only), pitting and~~	~~Chapter XI.M41, "Buried and Underground Piping and Tanks"~~Loss of	~~No~~AMP XI.M41, "Buried and Underground	~~VIII.H.SP-161~~No	~~N/A~~VIII.H.SP-161

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~piping elements~~BWR/PWR	~~crevice corrosion~~Underground steel, nickel alloy,, copper alloy piping, piping components exposed to air-indoor uncontrolled, condensation, air-outdoor (external)	material due to general (steel, copper alloy only), pitting, crevice corrosion	Piping and Tanks"		
~~51~~M	~~BWR/PWR~~ 51	~~Steel Piping, piping components, and piping elements exposed to Concrete~~BWR/PWR	~~None~~Steel piping, piping components exposed to concrete	None~~, provided~~ ~~1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and~~ ~~2) plant OE indicates no degradation of the concrete~~	~~No, if conditions are met.~~None	~~VIII.I.SP-154~~ Yes (SRP-SLR Section 3.4.2.2.8)	VIII.I~~-14(~~.SP-~~2)~~ 154
~~52~~M	~~BWR/PWR~~ 52	~~Aluminum Piping, piping components, and piping elements exposed to Gas, Air – indoor, uncontrolled~~	~~None~~Aluminum piping, piping components exposed to gas	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-23~~ ~~VIII.I.SP-93~~ No	VIII.I~~-1(~~.SP-23~~)~~ ~~N/A~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~(Internal/External)~~BWR/PWR					
~~53~~M	~~PWR~~53	~~Copper alloy (≤15% Zn and ≤8% Al) Piping, piping components, and piping elements exposed to Air with borated water leakage~~PWR	~~None~~Copper alloy piping, piping components exposed to air with borated water leakage	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-104~~ No	~~N/A~~ VIII.I.SP-104
~~54~~M	~~BWR/PWR~~ 54	~~Copper alloy Piping, piping components, and piping elements exposed to Gas, Air – indoor, uncontrolled (External)~~BWR/PWR	~~None~~Copper alloy piping, piping components exposed to gas, air – indoor uncontrolled (external)	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-5~~ ~~VIII.I.SP-6~~ No	VIII.I~~-3(~~.SP-5~~)~~ VIII.I~~-2(~~.SP-6~~)~~
~~55~~M	~~BWR/PWR~~ 55	~~Glass Piping elements exposed to Lubricating oil, Air – outdoor, Condensation (Internal/External), Raw water, Treated water, Air with borated water leakage, Gas,~~	~~None~~Glass piping elements exposed to lubricating oil, air – outdoor, condensation, raw water, treated water, air with borated water leakage, gas, closed-cycle cooling water, air – indoor uncontrolled (external)	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-10~~ ~~VIII.I.SP-108~~ ~~VIII.I.SP-111~~ ~~VIII.I.SP-33~~ ~~VIII.I.SP-34~~	VIII.I~~-6(~~.SP-10~~)~~ ~~N/A~~ ~~N/A~~ VIII.I~~-4(~~.SP-~~33)~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~Closed-cycle cooling water, Air – indoor, uncontrolled (External)~~BWR/PWR				~~VIII.I.SP-35~~ ~~VIII.I.SP-67~~ ~~VIII.I.SP-68~~ ~~VIII.I.SP-69~~ ~~VIII.I.SP-70~~ ~~VIII.I.SP-9~~ No	108 VIII.I~~-7(~~.SP-~~34)~~ 33 VIII.I~~-8(~~.SP-~~35)~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ 34 VIII.I~~-5(~~.SP-35 VIII.I.SP-67 VIII.I.SP-68 VIII.I.SP-69 VIII.I.SP-70 VIII.I.SP-9~~)~~

Table 3.4-1.	Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report						
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~56~~M	~~BWR/PWR~~ 56	~~Nickel alloy Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External)~~BWR/PWR	~~None~~Nickel alloy piping, piping components exposed to air – indoor uncontrolled (external)	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-11~~ No	VIII.I~~-9(~~.SP-11~~)~~
~~57~~M	~~BWR/PWR~~ 57	~~Nickel alloy, PVC Piping, piping components, and piping elements exposed to Air with borated water leakage, Air – indoor, uncontrolled, Condensation (Internal)~~BWR/PWR	~~None~~Nickel alloy, PVC Piping, piping components exposed to air with borated water leakage, air – indoor uncontrolled, condensation (internal)	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-148~~ ~~VIII.I.SP-152~~ ~~VIII.I.SP-153~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ VIII.I.SP-148 VIII.I.SP-152 VIII.I.SP-153
~~58~~M	~~BWR/PWR~~ 58	~~Stainless steel Piping, piping components, and piping elements exposed to Air – indoor, uncontrolled (External), Concrete, Gas, Air – indoor, uncontrolled (Internal)~~BWR/PWR	~~None~~Stainless steel piping, piping components exposed to air – indoor uncontrolled (external), gas, air – indoor uncontrolled (internal)	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-12~~ ~~VIII.I.SP-13~~ ~~VIII.I.SP-15~~ ~~VIII.I.SP-86~~ No	VIII.I~~-10(~~.SP-12~~)~~ VIII.I~~-11(~~.SP-~~13)~~ 15 VIII.I~~-12(~~.SP-~~15)~~ ~~N/A~~

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							86
~~59~~M	~~BWR/PWR~~ 59	~~Steel Piping, piping components, and piping elements exposed to Air – indoor controlled (External), Gas~~BWR/PWR	~~None~~Steel piping, piping components exposed to air – indoor controlled (external), gas	None	~~NA - No AEM or AMP~~None	~~VIII.I.SP-1~~ ~~VIII.I.SP-4~~ No	VIII.I~~-13(~~.SP-1~~)~~ VIII.I~~-15(~~.SP-4~~)~~
M	60	BWR/PWR	Any material piping, piping components exposed to treated water	Wall thinning due to erosion	AMP XI.M17, "Flow-Accelerated Corrosion"	No	VIII.D1.S-408 VIII.D2.S-408 VIII.G.S-408
M	61	BWR/PWR	Metallic piping, piping components, tanks exposed to raw water, waste water	Loss of material due to recurring internal corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.4.2.2.6)	VIII.A.S-400 VIII.B1.S-400 VIII.B2.S-400 VIII.C.S-400 VIII.D1.S-400 VIII.D2.S-400

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.E.S-400 VIII.F.S-400 VIII.G.S-400
M	62	BWR/PWR	Steel, stainless steel or aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to treated water	Loss of material due to general (steel only), pitting, crevice corrosion, MIC	AMP XI.M29, "Aboveground Metallic Tanks"	No	VIII.E.S-405 VIII.G.S-405
M	63	BWR/PWR	Insulated steel, copper alloy, copper alloy (> 15% Zn), aluminum piping, piping components, tanks exposed to condensation, air – outdoor	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion; cracking due to stress corrosion cracking (copper alloy (>15% Zn) only)	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VIII.H.S-402
M	64	BWR/PWR	Jacketed thermal insulation in an air – indoor uncontrolled, air – outdoor environment, air with borated water leakage, air with reactor coolant leakage, or air	Reduced thermal insulation resistance due to moisture intrusion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VIII.H.S-403

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			with steam or water leakage				
D	65	-	-	-	-	-	-
M	66	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, lubricating oil	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, physical damage, spalling for cementitious coatings/linings	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VIII.A.S-401 VIII.B1.S-401 VIII.B2.S-401 VIII.C.S-401 VIII.D1.S-401 VIII.D2.S-401 VIII.E.S-401 VIII.F.S-401 VIII.G.S-401
M	67	BWR/PWR	Any material piping, piping components, heat exchangers, tanks with internal	Loss of material due to general, pitting, crevice corrosion, MIC; fouling that leads	AMP XI.M42, "Internal Coatings/Linings for In-Scope	No	VIII.A.S-414 VIII.B1.S-414

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, lubricating oil	to corrosion; cracking due to stress corrosion cracking	Piping, Piping Components, Heat Exchangers, and Tanks"		VIII.B2.S-414 VIII.C.S-414 VIII.D1.S-414 VIII.D2.S-414 VIII.E.S-414 VIII.F.S-414 VIII.G.S-414
M	68	BWR/PWR	Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, waste water	Loss of material due to selective leaching	AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	VIII.A.S-415 VIII.B1.S-415 VIII.B2.S-415 VIII.C.S-415 VIII.D1.S-415 VIII.D2.S-415 VIII.E.S-415 VIII.F.S-415

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.G.S-415
N	69	BWR/PWR	Steel, stainless steel bolting exposed to condensation, lubricating oil	Loss of preload due to thermal effects, gasket creep, or self-loosening	AMP XI.M18, "Bolting Integrity"	No	VIII.H.S-416 VIII.H.S-417
N	70	BWR/PWR	Copper alloy bolting exposed to raw water, waste water	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M18, "Bolting Integrity"	No	VIII.H.S-418
N	71	BWR/PWR	Steel bolting exposed to lubricating oil	Loss of material due to general, pitting, crevice corrosion, MIC	AMP XI.M18, "Bolting Integrity"	No	VIII.H.S-419
N	72	BWR/PWR	Stainless steel, aluminum piping, piping components exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VIII.E.S-420 VIII.G.S-420
N	73	BWR/PWR	Stainless steel bolting exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	No	VIII.E.S-421 VIII.G.S-421
N	74	BWR/PWR	Underground stainless steel piping, piping components, tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.4.2.2.2)	VIII.H.S-425

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	75	BWR/PWR	Stainless steel, steel, aluminum, copper alloy, titanium heat exchanger components exposed to air (external)	Reduction of heat transfer due to fouling	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VIII.H.S-426
N	77	BWR/PWR	Elastomer seals, piping, piping components exposed to air – outdoor	Hardening and loss of strength due to elastomer degradation	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VIII.H.S-428
N	78	BWR/PWR	Elastomer seals, piping, piping components exposed to condensation	Hardening and loss of strength due to elastomer degradation	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VIII.D1.S-429 VIII.D2.S-429 VIII.E.S-429 VIII.G.S-429
N	80	BWR/PWR	Stainless steel, steel, nickel alloy, copper alloy, aluminum piping, piping components exposed to condensation	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VIII.H.S-431
N	81	BWR/PWR	Steel components exposed to treated water, raw water	Long-term loss of material due to general corrosion	AMP XI.M32, "One-Time Inspection"	No	VIII.A.S-432 VIII.B1.S-432

Table 3.4-1. **Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report**

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							VIII.B2.S-432 VIII.C.S-432 VIII.D1.S-432 VIII.D2.S-432 VIII.E.S-432 VIII.F.S-432 VIII.G.S-432
N	82	BWR/PWR	Stainless steel piping, piping components exposed to concrete	None	None	Yes (SRP-SLR Section 3.4.2.2.8)	VIII.I.SP-13
N	83	BWR/PWR	Stainless steel tanks exposed to treated water	Loss of material due to general (steel only), pitting, crevice corrosion, MIC	Plant-specific aging management program	Yes (SRP-SLR Section 3.4.2.2.9)	VIII.E.SP-162 VIII.G.SP-162
N	84	BWR/PWR	Stainless steel, nickel alloy piping, piping components exposed to steam	Loss of material due to pitting, crevice corrosion	AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection"	No	VIII.A.SP-155 VIII.B1.SP-155 VIII.B2.SP-155 VIII.B1.SP-157

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	85	BWR/PWR	Stainless steel piping, piping components, PWR heat exchanger components exposed to treated water	Loss of material due to pitting, crevice corrosion, MIC	Plant-specific aging management program	Yes (SRP-LR Section 3.4.2.2.9)	VIII.E.SP-80 VIII.E.SP-81 VIII.F.SP-81 VIII.B1.SP-87 VIII.C.SP-87 VIII.D1.SP-87 VIII.D2.SP-87 VIII.E.SP-87 VIII.F.SP-87 VIII.G.SP-87
N	86	BWR/PWR	Stainless steel, steel, aluminum, copper alloy, titanium heat exchanger components internal to components exposed to air (external)	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VIII.E.S-433 VIII.G.S-433

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	88	PWR	Copper alloy (≤8% Al) piping, piping components exposed to air with borated water leakage	None	None	No	VIII.I.S-435
N	89	BWR/PWR	Steel, stainless steel, copper alloy piping, piping components exposed to raw water (for components not covered by NRC GL 89-13)	Loss of material due to general (steel and copper alloy only), pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VIII.A.S-436 VIII.E.S-436 VIII.F.S-436 VIII.G.S-436
N	90	BWR/PWR	Steel, stainless steel, copper alloy heat exchanger components exposed to raw water (for components not covered by NRC GL 89-13)	Reduction of heat transfer due to fouling	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VIII.E.S-437 VIII.F.S-437 VIII.G.S-437
N	91	BWR/PWR	Steel, stainless steel, copper alloy heat exchanger components exposed to raw water (for components not covered by NRC GL 89-13)	Loss of material due to general (steel and copper alloy only), pitting, crevice corrosion, MIC	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	VIII.E.S-438 VIII.F.S-438 VIII.G.S-438

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	92	BWR/PWR	Copper alloy (>15% Zn or >8% Al) piping, piping components exposed to soil ground water	Loss of material due to selective leaching	AMP XI.M33, "Selective Leaching"	No	VIII.D1.S-439 VIII.D2.S-439 VIII.E.S-439 VIII.F.S-439 VIII.G.S-439
N	93	BWR/PWR	Stainless steel tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.4.2.2.2)	VIII.A.S-441 VIII.B1.S-441 VIII.B2.S-441 VIII.C.S-441 VIII.D1.S-441 VIII.D2.S-441 VIII.E.S-441 VIII.F.S-441 VIII.G.S-441

Table 3.4-1. **Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report**

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	94	BWR/PWR	Underground aluminum piping, piping components exposed to air (external)	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.4.2.2.10)	VIII.H.S-442
N	95	BWR/PWR	Underground stainless steel piping, piping components exposed to air-indoor uncontrolled, condensation, air-outdoor (external)	Loss of material due to pitting, crevice corrosion	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.4.2.2.3)	VIII.H.S-443
N	96	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	No	VIII.E.S-444 VIII.G.S-444
N	97	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air (external)	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.4.2.2.10)	VIII.E.S-445 VIII.G.S-445
N	98	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air, air – outdoor, air – indoor uncontrolled,	Loss of material due to pitting, crevice corrosion	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.4.2.2.3)	VIII.E.S-446 VIII.G.S-446

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			moist air, condensation (external)				
N	99	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete	Loss of material due to pitting, crevice corrosion, MIC (soil environment only)	AMP XI.M29, "Aboveground Metallic Tanks"	No	VIII.E.S-447 VIII.G.S-447
N	100	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to air – outdoor, air – indoor uncontrolled, air – indoor controlled, condensation (external)	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.4.2.2.2)	VIII.E.S-448 VIII.G.S-448
N	101	BWR/PWR	Stainless steel tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil, concrete	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	No	VIII.E.S-449 VIII.G.S-449
N	102	BWR/PWR	Aluminum tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks") exposed to soil,	Cracking due to stress corrosion cracking	AMP XI.M29, "Aboveground Metallic Tanks"	Yes (SRP-SLR Section 3.4.2.2.7)	VIII.E.S-450 VIII.G.S-450

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			concrete, air – outdoor, air – indoor uncontrolled, air – indoor controlled, raw water, waste water, condensation				
N	103	BWR/PWR	Insulated stainless steel piping, piping components, tanks exposed to condensation, air – outdoor	Loss of material due to pitting, crevice corrosion	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.4.2.2.3)	VIII.H.S-451
N	104	BWR/PWR	Insulated stainless steel tanks exposed to condensation, air – outdoor, air – indoor uncontrolled, air – indoor controlled	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.4.2.2.2)	VIII.H.S-452
N	105	BWR/PWR	Insulated aluminum tanks exposed to condensation, air – outdoor, air – indoor uncontrolled, air – indoor controlled	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.4.2.2.7)	VIII.H.S-453
N	106	BWR/PWR	Steel, stainless steel, copper alloy, copper alloy (> 15% Zn), nickel alloy piping, piping components exposed to air – outdoor	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion; cracking due to stress	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VIII.H.S-454

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				corrosion cracking (copper alloy (>15% Zn) only)			
N	107	BWR/PWR	Steel, stainless steel, copper alloy, copper alloy (> 15% Zn), nickel alloy tanks exposed to condensation	Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion; cracking due to stress corrosion cracking (copper alloy (>15% Zn) only)	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	VIII.H.S-455
N	108	BWR/PWR	Stainless steel piping, piping components, tanks exposed to condensation	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.4.2.2.2)	VIII.H.S-456
N	109	BWR/PWR	Aluminum piping, piping components, tanks exposed to condensation, raw water, waste water	Cracking due to stress corrosion cracking	AMP XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes (SRP-SLR Section 3.4.2.2.7)	VIII.H.S-457
N	110	BWR/PWR	Aluminum piping, piping components exposed to air – outdoor, raw water, waste water, condensation (internal)	Cracking due to stress corrosion cracking	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and	Yes (SRP-SLR Section 3.4.2.2.7)	VIII.D1.S-458 VIII.D2.S-458 VIII.E.S-

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
					Ducting Components"		458 VIII.F.S-458 VIII.G.S-458
N	111	BWR/PWR	Aluminum tanks exposed to raw water, waste water, condensation (internal)	Cracking due to stress corrosion cracking	AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	Yes (SRP-SLR Section 3.4.2.2.7)	VIII.D1.S-459 VIII.D2.S-459 VIII.E.S-459 VIII.F.S-459 VIII.G.S-459
N	112	BWR/PWR	Underground aluminum piping, piping components, tanks exposed to air – outdoor	Cracking due to stress corrosion cracking	AMP XI.M41, "Buried and Underground Piping and Tanks"	Yes (SRP-SLR Section 3.4.2.2.7)	VIII.H.S-460
N	113	BWR/PWR	Aluminum piping, piping components exposed to air – indoor uncontrolled	Loss of material due to pitting, crevice corrosion	Plant-specific aging management program	Yes (SRP-SLR Section 3.4.2.2.10)	VIII.I.S-461

Table 3.4-1. Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of the GALL-SLR Report

Table 3.4-2 ~~Aging Management Programs.~~ AMPs and Additional Guidance Appendices Recommended for Aging Management of Steam and Power Conversion System	
GALL-SLR Report Chapter/AMP	**Program Name**
~~Chapter~~AMP XI.M2	Water Chemistry
~~Chapter~~AMP XI.M10	Boric Acid Corrosion
~~Chapter~~AMP XI.M17	Flow-Accelerated Corrosion
~~Chapter~~AMP XI.M18	Bolting Integrity
~~Chapter~~AMP XI.M20	Open-Cycle Cooling Water System
~~Chapter~~AMP XI.M21A	Closed Treated Water Systems
~~Chapter~~AMP XI.M29	Aboveground Metallic Tanks
~~Chapter~~AMP XI.M32	One-Time Inspection
~~Chapter~~AMP XI.M33	Selective Leaching
~~Chapter~~AMP XI.M36	External Surfaces Monitoring of Mechanical Components
~~Chapter~~AMP XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
~~Chapter~~AMP XI.M39	Lubricating Oil Analysis
~~Chapter~~AMP XI.M41	Buried and Underground Piping and Tanks
AMP XI.M42	Internal Coatings/Linings for In Scope Piping, Piping Components, Heat Exchangers, and Tanks
GALL-SLR Report Appendix ~~for GALL~~A	Quality Assurance for Aging Management Programs
GALL-SLR Report Appendix B	Operating Experience for Aging Management Programs
SRP-~~LR~~SLR Appendix A.1	~~Plant-specific AMP~~Aging Management Review—Generic (Branch Technical Position RLSB-1)

3.5 Aging Management of Containments, Structures, and Component Supports

Review Responsibilities

Primary~~-~~— Branch assigned responsibility by Project Manager (PM) as described in ~~SRP-LR~~ Section 3.0~~.~~ of this Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR).

3.5.1 Areas of Review

This section addresses the aging management review (AMR) and the associated aging management ~~program (AMP~~programs (AMPs) for containments, structures~~,~~ and ~~component~~components (SC) supports. For a recent vintage plant, the information related to containments, ~~structures, and component~~ 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). For older vintage plants, the location of applicable information is plant-specific because an older plant’s FSAR may have predated NUREG~~-~~–0800. The scope of this section is ~~PWR and BWR~~ containment structures, and safety-related and other ~~structures, and component~~SC supports.

The pressurized water reactor (PWR) containment structures consist of concrete (reinforced or prestressed) and steel containments. The boiling water reactor (BWR) containment structures consist of Mark I, Mark II, and Mark III steel and concrete (reinforced or ~~pre-stressed)~~ prestressed) containments.

The safety-related structures (other than containments) 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, yard structures ~~(~~[auxiliary feedwater (AFW) pump house, utility/piping tunnels, security lighting poles, manholes, duct banks~~),~~], station blackout (SBO) structures (transmission towers, startup transformer circuit breaker foundation, electrical enclosure); Group 4: containment internal structures, excluding refueling canal; Group 5: fuel storage facility, refueling canal; Group 6: water-control structures (e.g., intake structure, cooling tower, and spray pond); Group 7: concrete tanks and missile barriers; Group 8: steel tank foundations and missile barriers; and Group 9: BWR unit vent stack.

The component supports are organized into seven groups: Group B1.1: supports for American Society of Mechanical Engineers (ASME) Class 1 piping and components; Group B1.2: supports for ASME Class 2 and 3 piping and components; Group B1.3: supports for ASME Class MC components; Group B2: supports for cable tray, conduit, heating, ventilation, and air conditioning (HVAC) ducts, TubeTrack®, instrument tubing, non-ASME piping and components; Group B3: anchorage of racks, panels, cabinets, and enclosures for electrical equipment and instrumentation; Group B4: supports for miscellaneous equipment ~~(~~[e.g., emergency diesel generator (EDG~~,~~), HVAC components~~);~~]; and Group B5: supports for miscellaneous structures (e.g., platforms, pipe whip restraints, jet impingement shields, masonry walls).

The responsible review organization is to review the following subsequent license renewal application (~~LRA~~SLRA) AMR and AMP items assigned to it, per SRP-~~LR~~SLR Section 3.0, for review:

AMRs

- AMR results consistent with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
- AMR results for which further evaluation is recommended ~~by the GALL Report~~
- AMR results that are not consistent with or not addressed in the GALL-SLR Report

AMPs

- Consistent with GALL-SLR AMPs
- Plant-specific AMPs

FSAR Supplement

- The responsible review organization is to review the FSAR Supplement associated with each assigned AMP.

3.5.2 Acceptance Criteria

The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the ~~NRC's~~U.S. Nuclear Regulatory Commission (NRC) regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21.

3.5.2.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The AMRs and the AMPs applicable to structures and component supports are described and evaluated in Chapters II and III of the ~~NUREG-1801, (~~GALL-SLR Report~~)~~.

The applicant's ~~LRA~~SLRA should provide sufficient information so that the reviewer is able to confirm that the specific ~~LRA~~SLRA AMR item and the associated ~~LRA~~SLRA AMP are consistent with the cited GALL-SLR Report AMR item. The ~~staff~~ reviewer should then confirm that the ~~LRA~~SLRA AMR item is consistent with the GALL-SLR Report AMR item to which it is compared.

When the applicant is crediting a different ~~aging management program~~AMP than recommended in the GALL-SLR Report, the reviewer should confirm that the alternate ~~aging management program~~AMP is valid to use for aging management and will be capable of managing the effects of aging as adequately as the ~~aging management program~~AMP recommended by the GALL-SLR Report.

3.5.2.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic acceptance criteria defined in Section 3.5.2.1 need to be applied first for all of the AMRs and AMPs as part of this section. In addition, if the GALL-SLR Report AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply ~~as identified by the GALL Report~~ for each of the following aging effect/aging mechanism combinations. Refer to Table 3.5-1, comparing the "Further Evaluation Recommended" column and the "~~Rev2~~GALL-SLR Item" column, for the AMR items that reference the following subsections. ~~The 2005 AMR item counterpart is provided in the "Rev1 Item" column.~~

3.5.2.2.1 ~~PWR~~Pressurized Water Reactor and ~~BWR~~Boiling Water Reactor Containments

3.5.2.2.1.1 Cracking and Distortion Due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, and Cracking Due to Differential Settlement and Erosion of Porous Concrete Subfoundations

Cracking and distortion due to increased stress levels from settlement could occur in PWR and BWR concrete and steel containments. The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. Also, reduction of foundation strength and cracking, due to differential settlement and erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. The existing program relies on the structures monitoring program to manage these aging effects. However, some plants may rely on a ~~de-watering~~dewatering system to lower the site ~~ground water~~groundwater level. If the plant's current licensing basis (CLB) credits a ~~de-watering~~dewatering system to control settlement, ~~the GALL Report recommends~~ further evaluation is recommended to verify the continued functionality of the ~~de-watering~~dewatering system during the subsequent period of extended operation.

3.5.2.2.1.2 Reduction of Strength and Modulus Due to Elevated Temperature

Reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR concrete and steel containments. The implementation of 10 CFR 50.55a and ASME Section XI, Subsection IWL would not be able to identify the reduction of strength and modulus of concrete due to elevated temperature. Subsection CC-3440 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. ~~The GALL Report recommends~~ Further evaluation is recommended of a plant-specific ~~aging management program~~AMP if any portion of the concrete containment components exceeds specified temperature limits~~,~~ {i.e., general area temperature greater than 66 °C ~~(~~[150 °F~~)~~] and local area temperature greater than 93 °C ~~(~~[200 °F~~).~~]}. Higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations. Acceptance criteria are described in Branch Technical Position (BTP) RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

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

1. Loss of material due to general, pitting, and crevice corrosion could occur in steel elements of inaccessible areas for all types of PWR and BWR containments. The existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. ~~The GALL Report recommends~~ Further evaluation is recommended of plant~~-~~-specific programs to manage this aging effect if

corrosion is indicated from the IWE examinations. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

2. Loss of material due to general, pitting, and crevice corrosion could occur in steel torus shell of Mark I containments. The existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. ~~The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect~~ If corrosion is significant~~.~~, recoating of the torus is recommended. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3. Loss of material due to general, pitting, and crevice corrosion could occur in steel torus ring girders and downcomers of Mark I containments, downcomers of Mark II containments, and interior surface of suppression chamber shell of Mark III containments. The existing program relies on ASME Section XI, Subsection IWE to manage this aging effect. ~~The GALL Report recommends~~ Further evaluation is recommended of plant-specific programs to manage this aging effect if corrosion is significant. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.5.2.2.1.4 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments 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). The evaluation of this TLAA is addressed separately in Section 4.5, “Concrete Containment Unbonded Tendon ~~Prestress~~Pre-stress Analysis,” of this SRP-~~LR~~SLR Report.

3.5.2.2.1.5 Cumulative Fatigue Damage

If included in the ~~current licensing basis~~CLB, fatigue analyses of metal liner, metal plates, suppression pool steel shells (including welded joints) and penetrations (including personnel airlock, equipment hatch, control rod drive (CRD) hatch, penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments and BWR vent header, vent line bellows, and downcomers are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.6, “Containment Liner Plates, Metal Containments, and Penetrations Fatigue Analysis,” of this SRP-~~LR~~SLR Report.

3.5.2.2.1.6 Cracking Due to Stress Corrosion Cracking

~~Cracking due to~~ Stress corrosion cracking (SCC) of stainless steel (SS) penetration bellows and dissimilar metal welds could occur in all types of PWR and BWR containments. The existing program relies on ASME Section XI, Subsection IWE and10 CFR Part 50, Appendix J, to manage this aging effect. ~~The GALL Report recommends~~ Further evaluation is recommended of additional appropriate examinations/evaluations implemented to detect these aging effects for ~~stainless steel~~SS penetration bellows and dissimilar metal welds.

3.5.2.2.1.7 Loss of Material (Scaling, Spalling) and Cracking Due to Freeze-Thaw

Loss of material (scaling, spalling) and cracking due to freeze-thaw could occur in inaccessible areas of PWR and BWR concrete containments. ~~The GALL Report recommends~~ Further evaluation is recommended of this aging effect for plants located in moderate to severe weathering conditions.

3.5.2.2.1.8 Cracking Due to Expansion From Reaction With Aggregates

Cracking due to expansion from reaction with aggregates could occur in inaccessible areas of concrete elements of PWR and BWR concrete and steel containments. ~~The GALL Report recommends~~ Further evaluation is recommended to determine if a plant-specific ~~aging management program~~AMP is required to manage this aging effect. A plant-specific aging management program is not required if (1) as described in NUREG–1557, investigations, tests, and petrographic examinations of aggregates performed in accordance with American Society for Testing and Materials (ASTM) C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within concrete, or (2) for potentially reactive aggregates, aggregate concrete reaction is not significant if it is demonstrated that the in-place concrete can perform its intended function. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.5.2.2.1.9 Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide and Carbonation

Increase in porosity and permeability due to leaching of calcium hydroxide and carbonation could occur in inaccessible areas of concrete elements of PWR and BWR concrete and steel containments. ~~The GALL Report recommends~~ Further evaluation is recommended if leaching is observed in accessible areas that impact intended functions. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

3.5.2.2.2.1 Aging Management of Inaccessible Areas

1. Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below~~-~~-grade inaccessible concrete areas of Groups 1~~-~~–3, 5 and 7~~-~~–9 structures. ~~The GALL Report recommends~~ Further evaluation is recommended of this aging effect for inaccessible areas of these Groups of structures for plants located in moderate to severe weathering conditions.

2. Cracking due to expansion and reaction with aggregates could occur in ~~below-grade~~ inaccessible concrete areas for Groups 1~~-~~–5 and 7~~-~~–9 structures. ~~The GALL Report recommends~~ Further evaluation is recommended of inaccessible areas of these Groups of structures ~~if concrete was not constructed in accordance with the recommendations in the GALL Report~~to determine if a plant-specific AMP is required to manage this aging effect.

3. Cracking and distortion due to increased stress levels from settlement could occur in below-grade inaccessible concrete areas of structures for all Groups, and reduction in foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1~~-~~–3, 5~~-~~–9 structures. The existing program relies on structure monitoring programs to manage these aging effects. Some plants may rely on a ~~de-~~

~~watering~~dewatering system to lower the site ~~ground water~~groundwater level. If the plant's CLB credits a ~~de-watering~~dewatering system, ~~the GALL Report recommends~~ verification is recommended of the continued functionality of the ~~de-watering~~dewatering system during the subsequent period of extended operation. ~~The GALL Report recommends~~ No further evaluation is recommended if this activity is included in the scope of the applicant's structures monitoring program.

4. Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation could occur in below-grade inaccessible concrete areas of Groups 1~~-~~–5 and 7~~-~~–9 structures. ~~The GALL Report recommends~~ Further evaluation is recommended if leaching is observed in accessible areas that impact intended functions.

3.5.2.2.2.2 Reduction of Strength and Modulus Due to Elevated Temperature

Reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR Group 1~~-~~–5 concrete structures. For any concrete elements that exceed specified temperature limits, further evaluations are recommended. Appendix A of American Concrete Institute (ACI) 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 66 °C ~~(~~[150 °F~~)~~] except for local areas, which are allowed to have increased temperatures not to exceed 93 °C ~~(~~[200°F~~). The GALL Report recommends~~]. Further evaluation is recommended of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits~~,~~ {i.e., general area temperature greater than 66 °C ~~(~~[150°F~~)~~] and local area temperature greater than 93 °C ~~(~~[200 °F~~).~~]}. Higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations. The acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.5.2.2.2.3 Aging Management of Inaccessible Areas for Group 6 Structures

~~The GALL Report recommends~~ Further evaluation is recommended for inaccessible areas of certain Group 6 structure/aging effect combinations as identified below, whether or not they are covered by inspections in accordance with the GALL-SLR Report, ~~Chapter~~AMP XI.S7, "~~Regulatory Guide 1.127,~~ Inspection of Water-Control Structures Associated with Nuclear Power Plants," or Federal Energy Regulatory Commission (FERC~~/US~~)/U.S. Army Corp of Engineers dam inspection and maintenance procedures.

1. Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below~~-~~-grade inaccessible concrete areas of Group 6 structures. ~~The GALL Report recommends~~ Further evaluation is recommended of this aging effect for inaccessible areas for plants located in moderate to severe weathering conditions.

2. Cracking due to expansion and reaction with aggregates could occur in ~~below-grade~~ inaccessible ~~reinforced~~ concrete areas of Group 6 structures. ~~The GALL Report recommends~~ Further evaluation is recommended to determine if a plant-specific ~~aging management program~~AMP is required to manage this aging effect. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3. Increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation could occur in inaccessible areas of concrete elements of

Group 6 structures. ~~The GALL Report recommends~~ Further evaluation is recommended if leaching is observed in accessible areas that impact intended functions. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.5.2.2.2.4 Cracking Due to Stress Corrosion Cracking, and Loss of Material Due to Pitting and Crevice Corrosion

Cracking due to ~~stress corrosion cracking~~systems, structures, and components (SSC) and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 ~~stainless steel~~SS tank liners exposed to standing water. ~~The GALL Report recommends~~ Further evaluation is recommended of plant-specific programs to manage these aging effects. The acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-~~-~~-1 (Appendix A.1 of this SRP-~~LR~~-SLR Report).

3.5.2.2.2.5 Cumulative Fatigue Damage Due to Fatigue

Fatigue of component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3 only if a CLB fatigue analysis exists. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3, “Metal Fatigue Analysis,” of this SRP-~~LR~~SLR Report.

3.5.2.2.2.6 Reduction of Strength and Mechanical Properties of Concrete Due to Irradiation

Reduction of strength, loss of mechanical properties, and cracking due to irradiation could occur in PWR and BWR Group 4 concrete structures that are exposed to high levels of neutron and gamma radiation. These structures include the reactor (primary/biological) shield wall, the sacrificial shield wall, and the reactor vessel support/pedestal structure. Data related to the effects and significance of neutron and gamma radiation on concrete mechanical and physical properties is limited, especially for conditions (dose, temperature, etc.) representative of light-water reactor (LWR) plants. However, based on literature review of existing research, radiation fluence limits of 1×10^{19} neutrons/cm^2 neutron radiation and 1×10^8 Gy [1×10^{10} rad] gamma dose are considered conservative radiation exposure levels beyond which concrete material properties may begin to degrade markedly (17, 18, 19).

Further evaluation is recommended of a plant-specific program to manage aging effects of irradiation if the estimated (calculated) fluence levels or irradiation dose received by any portion of the concrete from neutron (fluence cutoff energy E > 0.1 MeV) or gamma radiation exceeds the respective threshold level during the subsequent period of extended operation or if plant-specific operating experience of concrete irradiation degradation exists that may impact intended functions. Higher fluence or dose levels may be allowed in the concrete if tests and/or calculations are provided to evaluate the reduction in strength and/or loss of mechanical properties of concrete from those fluence levels, at or above the operating temperature experienced by the concrete, and the effects are applied to the design calculations. Supporting calculations/analyses, test data, and other technical basis are provided to estimate and evaluate fluence levels and the plant-specific program. The acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-SLR Report).

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in ~~Branch Technical Position~~BTP IQMB-1 (Appendix A.2 of this SRP-~~LR~~SLR Report).

3.5.2.2.4 Ongoing Review of Operating Experience

Acceptance criteria are described in Appendix A.4, “Operating Experience for AMPs.”

3~~AMR~~.5.2.3 Aging Management Review Results Not Consistent With or Not Addressed in the ~~GALL~~ Generic Aging Lessons Learned for Subsequent License Renewal Report

Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.5.2.4 Aging Management Programs

For those AMPs that will be used for aging management and are based on the program elements of an AMP in the GALL-SLR Report, the NRC reviewer performs an audit of ~~aging management programs~~AMPs credited in the ~~LRA~~SLRA to confirm consistency with the GALL-SLR AMPs identified in the GALL-SLR Report, ~~Chapters~~Chapter X~~ and~~, “Aging Management Programs That May Be Used to Demonstrate Acceptability of Time-Limited Aging Analyses in Accordance With Under 10 CFR 54.21(c) (1)(iii),” and Chapter XI~~.~~, “Chapter XI—Aging Management Programs.”

If the applicant identifies an exception to any of the program elements of the cited GALL-SLR Report AMP, the ~~LRA~~SLRA AMP should include a basis demonstrating how the criteria of 10 CFR 54.21(a)(3) would still be met. The NRC reviewer should then confirm that the ~~LRA~~SLRA AMP with all exceptions would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the ~~LRA~~SLRA AMP, the reviewer identifies a difference from the GALL-SLR Report AMP that should have been identified as an exception to the GALL-SLR Report AMP, this difference should be reviewed and properly dispositioned. The reviewer should document the disposition of all ~~LRA~~SLRA-defined exceptions and NRC staff-identified differences.

The ~~LRA~~SLRA should identify any enhancements that are needed to permit an existing ~~LRA~~SLRA AMP to be declared consistent with the GALL-SLR AMP to which the ~~LRA~~SLRA AMP is compared. The reviewer is to confirm both that the enhancement, when implemented, would allow the existing ~~LRA~~SLRA AMP to be consistent with the GALL-SLR AMP and that the applicant has a commitment in the FSAR supplement to implement the enhancement prior to the subsequent period of extended operation. The reviewer should document the disposition of all enhancements.

If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1.2.3 of this SRP-~~LR~~SLR Report).

3.5.2.5 ~~FSAR~~Final Safety Analysis Report Supplement

The summary description of the programs and activities for managing the effects of aging for the subsequent period of extended operation in the FSAR supplement should be appropriate, such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects are managed during the subsequent period of extended operation. The description should also contain any future aging management activities, including enhancements and commitments, to be completed before the subsequent period of extended operation. Table 3.0-1 of this SRP-~~LR~~SLR provides examples of the type of information to be included in the FSAR Supplement. Table 3.5-2 lists the programs that are applicable for this SRP-~~LR~~SLR subsection.

3.5.3 Review Procedures

For each area of review, the review procedures below are to be followed.

3.5.3.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The applicant may reference the GALL-SLR Report in its ~~LRA~~SLRA, as appropriate, and demonstrate that the AMRs and AMPs at its facility are consistent with those reviewed and approved in the GALL-SLR Report. The reviewer should not conduct a ~~re-~~review of the substance of the matters described in the GALL-SLR Report. If the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL-SLR Report, the reviewer should find acceptable the applicant's reference to GALL-SLR in its ~~LRA.~~SLRA. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the ~~applicant has stated that the~~ applicable aging effects ~~and~~have been addressed based on the staff's review of industry and plant-specific operating experience~~ have been reviewed by the applicant and are evaluated in the GALL Report~~.

Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL-SLR Report. Performance of this review requires the reviewer to confirm that the applicant has identified those aging effects for the ~~structures and component~~SC supports that are contained in the GALL-SLR Report as applicable to its plant.

3.5.3.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic review procedures defined in Section 3.5.3.1 need to be applied first for all of the AMRs and AMPs provided in this section. In addition, if the GALL-SLR AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that further evaluation is recommended, then additional criteria apply~~ as identified by the GALL Report~~ for each of the following aging effect/aging mechanism combinations.

3.5.3.2.1 ~~PWR~~Pressurized Water Reactor and ~~BWR~~Boiling Water Reactor Containments

3.5.3.2.1.1 Cracking and Distortion Due to Increased Stress Levels From Settlement; Reduction of Foundation Strength and Cracking Due to Differential Settlement and Erosion of Porous Concrete Subfoundations

~~The GALL Report recommends~~ Further evaluation is recommended of aging management of (1) cracking and distortion due to increases in component stress level from settlement for PWR and BWR concrete and steel containments and (2) reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundations for all types of PWR and BWR containments if a ~~de-watering~~dewatering system is relied upon to control settlement. The reviewer reviews and confirms that, if the applicant credits a ~~de-watering~~dewatering system in its CLB, the applicant has committed to monitor the functionality of the ~~de-watering~~dewatering system under the applicant's ASME Code Section XI, Subsection IWL or the structures monitoring program. If not, the reviewer evaluates the plant~~-~~-specific program for monitoring the ~~de-watering~~dewatering system during the subsequent period of extended operation.

3.5.3.2.1.2 Reduction of Strength and Modulus Due to Elevated Temperature

~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage reduction of strength and modulus of concrete due to elevated temperature for PWR and BWR concrete and steel containments. ~~The GALL Report notes that~~ The implementation of ASME Section XI, Subsection IWL examinations and 10 CFR 50.55a would not be able to detect the reduction of concrete strength and modulus due to elevated temperature and also notes that no mandated aging management exists for managing this aging effect.

~~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 greater than 66 °C ~~(~~[150°F~~)~~] and local area temperature greater than 93 °C ~~(~~[200°F~~). The GALL Report also states that~~]}. Higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations. The reviewer reviews and confirms that the applicant's discussion in the renewal application indicates that the affected PWR and BWR containment components are not exposed to a temperature that exceeds the temperature limits. If active cooling is relied upon to maintain acceptable temperatures, then the reviewer ensures that the cooling system is being properly age-managed or temperatures are being monitored to identify a problem with the cooling system. If the limits are exceeded the reviewer reviews the technical basis (i.e., tests and/or calculations) provided by the applicant to justify the higher temperature. Otherwise, the reviewer reviews the applicant's proposed programs to ensure that the effects of elevated temperature will be adequately managed during the subsequent period of extended~~ operation.~~.

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

1. The GALL-SLR Report identifies programs to manage loss of material due to general, pitting, and crevice corrosion in inaccessible areas of the steel elements in drywell and torus or the steel liner and integral attachments for all types of PWR and BWR containments. The ~~aging management program~~AMP consists of ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, leak tests. Subsection IWE exempts from examination portions of the containments that are inaccessible, such as embedded or inaccessible portions of steel liners and steel elements in drywell and torus, and integral attachments.

   To cover the inaccessible areas, 10 CFR 50.55a(b)(2)(ix) requires that the applicant ~~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. In addition, ~~the GALL Report recommends~~ further evaluation of plant~~-~~-specific programs to manage the aging effects for inaccessible areas ~~if specific recommendations defined in the GALL Report~~is recommended if the following cannot be satisfied~~.~~: (1) concrete meeting the requirements of ACI 318 or 349 and the guidance of 201.2R was used for the containment concrete in contact with the embedded containment shell or liner; (2) the moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with ASME Section XI, Subsection IWE requirements; (3) the concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner; and (4) borated water spills and water ponding on the concrete floor are common and when detected are cleaned up or diverted to a sump in a timely manner. Operating experience has identified significant corrosion in some plants. If any of the above conditions cannot be satisfied, then a plant-specific AMP for corrosion is necessary. The reviewer reviews the applicant's proposed ~~aging management program~~AMP to confirm that, where appropriate, an effective inspection program has been developed and implemented to ensure that the aging effects in inaccessible areas are adequately managed.

2. The GALL-SLR Report identifies programs to manage loss of material due to general, pitting, and crevice corrosion in steel torus shell of Mark I containments. The ~~aging management program~~AMP consists of ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, leak tests. In addition, ~~the GALL Report recommends~~ further evaluation is recommended of plant-specific programs to manage the aging effects if corrosion is significant. Further evaluation of torus shell corrosion is warranted as a result of industry-wide operating experience that identified a number of incidences of torus corrosion. The reviewer reviews the applicant's proposed ~~aging management program~~AMP to confirm that, where appropriate, an effective inspection program has been developed and implemented to ensure that the aging effects are adequately managed. A plant-specific program may include the ~~re-coating~~recoating of the torus, if necessary.

3. The GALL-SLR Report identifies programs to manage loss of material due to general, pitting, and crevice corrosion in steel torus ring girders and downcomers of Mark I containments, suppression chambers and downcomers of Mark II containments, and interior surface of suppression chamber shell of Mark III containments. ~~The~~ GALL-SLR Report ~~recommends GLAL~~ AMP XI.S1, "ASME Section XI, Subsection IWE," is recommended for aging management. In addition, ~~the GALL Report recommends~~

further evaluation of plant-specific programs is recommended to manage the aging effects if plant operating experience identified significant corrosion of the torus ring girders, downcomers and suppression chambers.

3.5.3.2.1.4 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Loss of prestress is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.5 of this SRP-~~LR~~SLR.

3.5.3.2.1.5 Cumulative Fatigue Damage

Fatigue analyses included in ~~current licensing basis~~the CLB for the containment liner plate, penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments and BWR suppression pool steel shells, vent header, vent line bellows, and downcomers are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.6 of this SRP-~~LR~~SLR Report.

3.5.3.2.1.6 Cracking Due to Stress Corrosion Cracking

~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage cracking due to SCC for ~~stainless steel~~SS penetration sleeves, dissimilar metal welds, and penetration bellows in all types of PWR and BWR containments. Transgranular stress corrosion cracking (TGSCC) is a concern for dissimilar metal welds. In the case of bellows assemblies, SCC may cause aging effects particularly if the material is not shielded from a corrosive environment. Containment inservice inspection (ISI) IWE and leak rate testing may not be sufficient to detect cracks, especially for dissimilar metal welds. Additional appropriate examinations to detect SCC in bellows assemblies and dissimilar metal welds are recommended to address this issue. The reviewer reviews and evaluates the applicant's proposed programs to confirm that adequate inspection methods will be implemented to ensure that cracks are detected.

3.5.3.2.1.7 Loss of Material (Scaling, Spalling) and Cracking Due to Freeze-Thaw

~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage loss of material (scaling, spalling) and cracking due to freeze-thaw for concrete elements of PWR and BWR containments. Containment ISI Subsection IWL may not be sufficient for plants located in moderate to severe weathering conditions. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG~~-~~–1557). The weathering index for the continental United States is shown in ASTM C33-90, ~~Fig.~~Figure 1. A plant-specific program is not required if documented evidence confirms that ~~where~~ the existing concrete had air content of 3~~%~~ percent to 8~~%~~ percent (including tolerance~~),~~) and subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. Such inspections are considered a part of the evaluation. The reviewer reviews and confirms that the applicant has satisfied the recommendations for inaccessible concrete ~~as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant's proposed ~~aging management program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that these aging effects in inaccessible areas for plants located in moderate to severe weathering conditions are adequately managed.

3.5.3.2.1.8 Cracking Due to Expansion from Reaction With Aggregates

~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage cracking due to expansion and reaction with aggregates in inaccessible areas of concrete elements of PWR and BWR concrete and steel containments. A plant-specific ~~aging management program~~AMP is ~~not~~ necessary if (1) ~~investigations,~~reactivity tests~~, and~~ or petrographic examinations of concrete samples identify reaction with aggregates ~~performed in accordance with ASTM C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within concrete~~ , or (2) ~~for potentially reactive aggregates,~~visual inspections of accessible concrete have identified indications of aggregate ~~concrete reaction is not significant if~~reactions, such as “map” or “patterned” cracking or the ~~structure was constructed in accordance with ACI 318.~~presence of reaction byproducts (e.g., alkali-silica gel). The reviewer confirms that the applicant has ~~satisfied these~~not identified one of the above conditions ~~for inaccessible concrete as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant’s proposed ~~aging management program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas is adequately managed.

3.5.3.2.1.9 Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide and Carbonation

~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage increase in porosity and permeability due to leaching of calcium hydroxide and carbonation in inaccessible areas of PWR and BWR concrete and steel containments. A plant-specific ~~aging management program~~AMP is not required, even if reinforced concrete is exposed to flowing water if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation, or (2) evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure. The reviewer confirms that the applicant has satisfied these conditions ~~as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant’s proposed ~~aging management program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas is adequately managed.

3.5.3.2.2 Safety-Related and Other Structures, and Component Supports

3.5.3.2.2.1 Aging Management of Inaccessible Areas

1. ~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Groups 1~~-~~–3, 5, and 7~~-~~–9 structures. Structure monitoring programs may not be sufficient for plants located in moderate to severe weathering conditions. Further evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG~~-~~–1557). The weathering index for the continental United States is shown in ASTM C33-90, ~~Fig.~~Figure 1. A plant-specific program is not required if documented evidence confirms that ~~where~~ the existing concrete had air content of 3~~%~~ percent to 8~~%~~ percent and subsequent inspection did not exhibit degradation related to freeze-thaw. Such inspections should be considered a part of the evaluation. The reviewer confirms that the applicant has satisfied these conditions ~~as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant’s proposed ~~aging management~~

~~program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas for plants located in moderate to severe weathering conditions is adequately managed.

2. ~~The GALL Report recommends~~ Further evaluation is recommended to determine if a plant-specific program is required to manage cracking due to expansion from reaction with aggregates in ~~below-grade~~ inaccessible concrete areas of Groups 1~~-~~–5 and 7~~-~~–9 structures. A plant-specific program is ~~not~~ required if (1) ~~investigations,~~reactivity tests~~,~~ ~~and~~ or petrographic examinations of concrete samples identify reaction with aggregates ~~performed in accordance with ASTM C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within reinforced concrete~~, or (2) ~~for potentially reactive aggregates, aggregate-reinforced~~visual inspections of accessible concrete ~~reaction is not significant if~~have identified indications of aggregate reactions, such as “map” or “patterned” cracking or the ~~structure was constructed in accordance with ACI 318.~~presence of reaction byproducts (e.g., alkali-silica gel). The reviewer confirms that the applicant has ~~satisfied these~~not identified one of the above conditions ~~as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant’s proposed ~~aging management program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that the aging effect is adequately managed.

3. ~~The GALL Report recommends~~ Further evaluation is recommended of aging management of (a) cracking and distortion due to increased stress levels from settlement for inaccessible concrete areas of structures for all Groups and (b) reduction of foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations for inaccessible concrete areas of Groups 1~~-~~–3, and 5~~-~~–9 structures if a ~~de-watering~~dewatering system is relied upon to manage the aging effect. The reviewer confirms that, if the applicant’s plant credits a ~~de-watering~~dewatering system in its CLB, the applicant has committed to monitor the functionality of the ~~de-watering~~dewatering system under the applicant’s structures monitoring program. If not, the reviewer reviews and evaluates the plant~~-~~-specific program for monitoring the ~~de-watering~~dewatering system during the subsequent period of extended operation.

4. ~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage increase in porosity and permeability due to leaching of calcium hydroxide and carbonation in below-grade inaccessible concrete areas of Groups 1~~-~~–5, and 7~~-~~–9 structures. A plant~~-~~-specific ~~aging management program~~AMP is not required for the reinforced concrete exposed to flowing water if (1) there is evidence in the accessible areas that the flowing water has not caused leaching of calcium hydroxide and carbonation or (2) evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure. The reviewer confirms that the applicant has satisfied these conditions ~~as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant’s proposed ~~aging management program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas is adequately managed.

3.5.3.2.2.2 Reduction of Strength and Modulus Due to Elevated Temperature

~~The GALL Report recommends~~ Further evaluation is recommended of programs to manage reduction of strength and modulus of concrete structures due to elevated temperature for PWR and BWR safety-related and other structures.

~~The GALL Report recommends that~~ A plant-specific evaluation should be performed if any portion of the concrete Groups 1~~-~~–5 structures exceeds specified temperature limits~~,~~ {i.e., general temperature greater than 66 °C ~~(~~[150 °F~~)~~] and local area temperature greater than 93 °C ~~(~~[200 °F~~). The GALL Report also states that~~]}. Higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations. The reviewer reviews and confirms that the applicant's discussion in the renewal application indicates that the affected Groups 1~~-~~–5 structures are not exposed to temperature that exceeds the temperature limits. If active cooling is relied upon to maintain acceptable temperatures, then the reviewer ensures that the cooling system is being properly age-managed or temperatures are being monitored to identify a problem with the cooling system. If the limits are exceeded the reviewer reviews the technical basis (i.e., tests and/or calculations) provided by the applicant to justify the higher temperature. Otherwise the reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that the effects of elevated temperature will be adequately managed during the subsequent period of extended operation.

3.5.3.2.2.3 Aging Management of Inaccessible Areas for Group 6 Structures

~~The GALL Report recommends~~ Further evaluation is recommended for inaccessible areas of certain Group 6 structure/aging effect combinations as identified below, whether or not they are covered by inspections in accordance with ~~the~~ GALL-SLR Report~~, Chapter~~ AMP XI.S7, ~~"Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,"~~ or FERC/US Army Corp of Engineers dam inspection and maintenance procedures.

1. Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below~~-~~-grade inaccessible concrete areas of Group 6 structures. Further evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG~~-~~–1557, Ref. 7). The weathering index for the continental ~~US~~U.S. is shown in ASTM C33-90, ~~Fig.~~Figure 1. A plant-specific program is not required if documented evidence confirms that ~~where~~ the existing concrete had air content of 3~~%~~ percent to 8~~%~~ percent and subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. Such inspections should be considered a part of the evaluation. The reviewer reviews and confirms that the applicant has satisfied these conditions~~ as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant's proposed ~~aging management program~~AMP to determine that, where appropriate, an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas for plants located in moderate to severe weathering conditions will be adequately managed.

2. Cracking due to expansion from reaction with aggregates could occur in ~~below-grade~~ inaccessible concrete areas of Group 6 structures. ~~The GALL Report recommends~~ Further evaluation is recommended to determine if a plant-specific program is required to manage the aging effect. A plant specific program is ~~not~~ required if (1) ~~investigations,~~reactivity tests~~, and~~ or petrographic examinations of concrete samples identify reaction with aggregates~~ performed in accordance with ASTM C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within reinforced concrete~~ , or (2)~~ for potentially reactive aggregates, aggregate-reinforced~~ visual inspections of accessible concrete ~~reaction is not significant if~~have identified indications of aggregate reactions, such as "map" or "patterned" cracking or the ~~structure was constructed in accordance with ACI 318.~~presence of reaction byproducts (e.g., alkali-silica gel). The reviewer confirms that the applicant has ~~satisfied these~~not identified one of the above conditions~~ for inaccessible concrete as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant's proposed ~~aging management program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that the aging effect will be adequately managed.

3. Increase in porosity and permeability due to leaching of calcium hydroxide and carbonation could occur in below-grade inaccessible concrete areas of Group 6 structures. ~~The GALL Report recommends~~ Further evaluation is recommended to determine if a plant-specific program is required to manage the aging effect. A plant-specific program is not required for the reinforced structures exposed to flowing water if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation, or (2) evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure. The reviewer confirms that the applicant has satisfied

these conditions~~ as identified in the GALL Report.~~. Otherwise, the reviewer reviews the applicant’s proposed ~~aging management program~~AMP to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas will be adequately managed.

3.5.3.2.2.4 Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion

~~The GALL Report recommends~~ Further evaluation is recommended of plant-specific programs to manage cracking due to SCC and loss of material due to pitting and crevice corrosion for ~~stainless steel~~SS tank liners exposed to standing water. The reviewer reviews the applicant’s proposed ~~aging management program~~AMP on a case-by-case basis to ensure that the intended functions will be maintained during the subsequent period of the extended operation.

3.5.3.2.2.5 Cumulative Fatigue Damage

Fatigue of support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3 only if a CLB fatigue analysis exists. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3 of this SRP-~~LR~~SLR Report.

3.5.3.2.2.6 Reduction of Strength and Mechanical Properties of Concrete Due to Irradiation

Further evaluation is recommended of a plant-specific program to manage reduction of strength, loss of mechanical properties, and of concrete due to irradiation in PWR and BWR Group 4 concrete structures, exposed to high levels of neutron and gamma radiation. These structures include the reactor (primary/biological) shield wall, the sacrificial shield wall, and the reactor vessel support/pedestal structure. The irradiation mechanism consists of radiation interactions with the material and heating due to absorption of radiation energy at the operating temperature experienced by the concrete. The intensity of radiation is typically characterized by the measure of its field or fluence. Both neutron and gamma radiation produce internal heating from absorption of radiation energy and, at high fluence levels, changes in microstructure and certain mechanical properties of concrete (e.g., compressive strength, tensile strength, modulus of elasticity) from radiation interactions with the material. Limited data are available in the open literature related to the effects and significance of radiation fluences (neutron and gamma radiation) on intended functions of concrete structures, especially for conditions (dose, temperature, etc.) representative of existing LWR plants. However, based on literature review of existing research, fluence limits of 1×10^{19} neutrons/cm^2 neutron radiation and 1×10^8 Gy [1×10^{10} rad] gamma dose are considered conservative radiation exposure levels beyond which concrete material properties may begin to degrade markedly.

Plant-specific calculations/analyses should be performed to identify the neutron (fluence cutoff energy E > 0.1 MeV) and gamma fields that develop in any portion of the concrete structures of interest at 80 years of operation and compare them to the above threshold limits. The impact of any plant-specific operating experience of concrete irradiation effects on intended functions are evaluated. The reviewer reviews these analyses, operating experience and supporting technical basis (e.g., calculations, test data) on a case-by-case basis. Higher fluence or dose levels may be allowed in the concrete if tests and/or calculations are provided to evaluate the reduction in strength and/or change in mechanical properties of concrete, if any, from those fluence levels and the effects are applied to the design calculations. The reviewer confirms that the applicant’s discussion in the SLRA indicates that the affected PWR and BWR concrete components are not exposed to neutron and gamma radiation fluence levels that exceed the threshold limits. The reviewer also confirms that the impact of any plant-specific operating experience of concrete irradiation degradation on intended functions is addressed. If the limits are exceeded, the technical basis (i.e., tests and/or calculations) provided by the applicant to justify higher fluence or dose limits is reviewed. Otherwise, the applicant's proposed plant-specific program and the supporting technical basis is reviewed to ensure that the effects of irradiation on the concrete components will be adequately managed during the subsequent period of extended operation.

3.5.3.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's ~~aging management programs~~AMP for subsequent license renewal (SLR) should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an AMR for ~~license renewal.~~SLR. Nevertheless, an applicant has the option to expand the scope of its 10 CFR Part 50 Appendix B program to include these components and address these program elements. If the applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If the applicant chooses alternative means, the branch responsible for quality assurance (QA) should be requested to review the applicant's proposal on a case-by-case basis.

3.5.3.2.4 Ongoing Review of Operating Experience

The applicant's AMPs should contain the element of operating experience. The reviewer verifies that the applicant has appropriate programs or processes for the ongoing review of both plant-specific and industry operating experience concerning age-related degradation and aging management. Such reviews are used to ensure that the AMPs are effective to manage the aging effects for which they are created. The AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Additional information is in Appendix A.4, "Operating Experience for Aging Management Programs."

In addition, the reviewer confirms that the applicant has provided an appropriate summary description of these activities in the FSAR supplement. An example description is under "Operating Experience" in Table 3~~—AMR~~.0-1, "FSAR Supplement for Aging Management of Applicable Systems."

3.5.3.3 Aging Management Review Results Not Consistent With or Not Addressed in the ~~GALL~~ Generic Aging Lessons Learned for Subsequent License Renewal Report

The reviewer should confirm that the applicant, in their ~~LRA~~SLRA, has identified applicable aging effects, listed the appropriate combination of materials and environments, and credited AMPs that will adequately manage the aging effects. The AMP credited by the applicant could be an AMP that is described and evaluated in the GALL-SLR Report or a plant-specific program. Review procedures are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR Report).

3.5.3.4 Aging Management Programs

The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL-SLR Report. If the applicant commits to an enhancement to make its ~~LRA~~SLRA AMP consistent with a GALL-SLR Report AMP, then the reviewer is to confirm that this enhancement, when implemented, will make the ~~LRA~~SLRA AMP consistent with the GALL-SLR Report AMP. If the applicant identifies, in the ~~LRA~~SLRA AMP, an exception to any of the program elements of the GALL-SLR Report AMP, the reviewer is to confirm that the ~~LRA~~SLRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3). If the reviewer identifies a difference, not identified by the ~~LRA~~SLRA, between the ~~LRA AMP and the GALL Report~~SLRA AMP and the GALL-SLR Report AMP, with which the ~~LRA~~SLRA claims to be consistent, the reviewer should confirm that the ~~LRA~~SLRA AMP with this difference satisfies 10 CFR 54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions, or differences. The AMPs evaluated in the GALL-SLR Report pertinent to the containments, ~~structures, and component~~SC supports are summarized in Table 3.5-1 of this SRP-~~LR.~~SLR. The "~~Rev 2~~GALL-SLR Item" ~~(for 2010) and "Rev1 Item" (for 2005 counterpart) columns identify the~~ column identifies the AMR item numbers in the GALL-SLR Report, Chapters II and III, presenting detailed information summarized by this row.

Table 3.5-1 of this SRP-~~LR~~SLR may identify a plant-specific ~~aging management program.~~AMP. If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1.2.3 of this SRP-~~LR~~-SLR Report).

3.5.3.5 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer confirms that the applicant has provided in its FSAR supplement information equivalent to that in Table 3.0-1 for aging management of the containments, ~~structures, and component~~SC supports. Table 3.5-2 lists the AMPs that are applicable for this SRP-~~LR~~SLR subsection. The reviewer also confirms that the applicant has provided information for Subsection 3.5.3.3, "AMR Results Not Consistent With or Not Addressed in the GALL-SLR Report," equivalent to that in Table 3.0-1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change and finds it acceptable pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.

As noted in Table 3.0-1, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should confirm that the applicant has identified and committed in the ~~license renewal~~SLR application to any future aging management activities, including enhancements and commitments, to be completed before the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

3.5.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of this section, then an evaluation finding similar to the following text should be included in the NRC staff's safety evaluation report:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has demonstrated that the aging effects associated with the containments, structures, and component supports components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

The NRC staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the containments, structures, and component supports, as required by 10 CFR 54.21(d).

3.5.5 Implementation

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

3.5.6 References

1. 10 CFR Part 50, ~~Appendix B,~~ "Quality Assurance Criteria for Nuclear Power Plants~~,"~~ ~~Office of the Federal Register, National Archives and Records Administration, 2009~~." Appendix B. Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

2. 10 CFR Part 50.55a, "Codes and Standards~~," Office of the Federal Register, National Archives and Records Administration, 2009~~." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

3. 10 CFR Part 50.59, "Changes, Tests, and Experiments~~," Office of the Federal Register, National Archives and Records Administration, 2009~~." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

4. 10 CFR Part 50, ~~Appendix J,~~ "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors~~," Office of the Federal Register, National Archives and Records Administration, 2009~~." Appendix J. Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

5. 10 CFR Part 50.71, "Maintenance of Record, Making of Reports~~," Office of the Federal Register, National Archives and Records Administration, 2009~~." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

6. 10 CFR Part 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants~~," Office of the Federal Register, National Archives and Records Administration, 2009~~." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

7. 10 CFR 54.4, "Scope~~, Office of the Federal Register," National Archives and Records Administration, 2009~~." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

~~8.~~ NRC. Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants~~,"~~." Revision 1~~, U.S. Nuclear Regulatory Commission, March 1978.~~

~~9.~~8. ~~NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,"~~. Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March ~~2007~~1978.

~~10. NUREG-1801, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

~~11.~~9. NEI. NEI 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54~~—~~–The License Renewal Rule~~,”~~.” Revision 6. Washington, DC: Nuclear Energy Institute~~, Revision 6~~. 1995.

~~12.~~10. 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~~,” The~~.” ASME Boiler and Pressure Vessel Code, 2004 Edition~~ as approved in 10 CFR 50.55a, The~~. New York City, New York: American Society of Mechanical Engineers~~, New York, NY.~~.

~~13.~~11. 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~~,” The~~.” ASME Boiler and Pressure Vessel Code, 2004 Edition~~ as approved in 10 CFR 50.55a, the~~. New York City, New York: American Society of Mechanical Engineers~~, New York, NY.~~.

~~14.~~12. 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~~,” The~~.” ASME Boiler and Pressure Vessel Code, 2004 Edition~~ as approved in 10 CFR 50.55a, The~~. New York City, New York: American Society of Mechanical Engineers~~, New York, NY.~~.

~~15.~~13. NEI. NUMARC 93-01, ~~Rev. 2,~~ “Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants~~” [Line-In/Line-Out Version],~~.” Revision 2. Washington, DC: Nuclear Energy Institute~~,~~. April 1996.

~~16.~~14. NRC. Regulatory Guide 1.160, ~~Revision 2,~~ “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants~~,”~~.” Revision 2. ML003761662. March 31 1997.

~~17.~~15. NRC. NUREG~~-~~–1557~~, October 1996~~, “Summary of Technical Information and Agreements from Nuclear Management and Resource Council Industry Report addressing License Renewal.” Washington, DC: U.S. Nuclear Regulatory Commission. October 1996.

~~18.~~16. ACI. Standard 318, “Building Code Requirements for Reinforced Concrete and Commentary~~,”~~.” Farmington Hills, Michigan: American Concrete Institute.

17. Hilsdorf, H.K., J. Kropp, and H.J. Koch. “The Effects of Nuclear Radiation on the Mechanical Properties of Concrete.” ACI SP 55-10. pp 223-251. 1978.

18. NRC. NUREG/CR–7171, “A Review of the Effects of Radiation on Microstructure and Properties of Concretes Used in Nuclear Power Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. November 2013

19. Field, K.G., Y. Le Pape, and I. Remec. “Perspectives on Radiation Effects in Concrete for Nuclear Power Plants–Part I: Quantification of Radiation Exposure and Radiation Effects.” *Nuclear Engineering and Design.* Vol 285. pp 126–143. February 2015.

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
M	1	BWR/PWR	Concrete: dome; wall; basemat; ring girders; buttresses, concrete elements, all	~~PWR Concrete (Reinforced and Prestressed) and Steel Containments~~ ~~BWR Concrete and Steel (Mark I, II, and III) Containments~~ Cracking and distortion due to increased stress levels from settlement	AMP XI.S2, "ASME Section XI, Subsection IWL," and/or AMP XI.S6, "Structures Monitoring"	Yes (SRP-SLR Section 3.5.2.2.1.1)	II.A1.CP-101 II.A2.CP-69 II.B1.2.CP-105 II.B2.2.CP-105 II.B3.1.CP-69 II.B3.2.CP-105
~~1~~M	~~BWR/PWR~~2	~~Concrete: dome; wall; basemat; ring girders; buttresses, Concrete elements, all~~BWR/PWR	~~Cracking and distortion due to increased stress levels from settlement~~Concrete: foundation; subfoundation	~~Chapter XI.S2, "ASME Section XI, Subsection IWL" or Chapter XI.S6, "Structure Monitoring"~~ ~~If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering~~	~~Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.1.1)~~AMP XI.S6, "Structures Monitoring"	~~II.A1.CP-101~~ ~~II.A2.CP-69~~ ~~II.B1~~Yes (SRP-SLR Section 3.5.2.~~CP-105~~ ~~II.B2.~~2.~~CP-105~~ ~~II.B3.~~1.~~CP-69~~	II.A1~~-5(~~.C-~~37)~~07 II.A2~~-5(~~.C-~~36)~~07 II.B1.2~~-1(~~.C-~~06)~~

Table 3.5-1.   Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~system through the period of extended operation.~~Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation		~~II.B3.2.CP-105~~ 1)	07 II.B2.2~~-1(~~.C-~~06)~~ 07 II.B3.1~~-2(~~.C-~~36)~~ 07 II.B3.2~~-1(~~.C-~~06)~~ 07
~~2~~M	~~BWR/PWR~~3	~~Concrete: foundation; subfoundation~~BWR/PWR	~~Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation~~Concrete: dome; wall; basemat; ring girders; buttresses, concrete: containment; wall; basemat, concrete: basemat, concrete fill-in annulus	~~Chapter XI.S6, "Structures Monitoring"~~ ~~If a de-watering system is relied upon for control of erosion, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.~~Reduction of strength and modulus of elasticity due to elevated temperature	~~Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.1.1)~~Plant-specific aging management program	~~II.A1.C-07~~ ~~II.A2.C-07~~ ~~II.B1~~Yes (SRP-SLR Section 3.5.2.~~C-07~~ ~~II.B2.~~2.~~C-07~~ ~~II.B3.~~1.~~C-07~~ ~~II.B3.~~2.~~C-07~~)	II.A1~~-8(C-07)~~ ~~II.A2-8(C-07)~~ .CP-34 II.B1.2~~-7(C-07)~~ .CP-57 II.B2.2~~-7(C-07)~~ .CP-57 II.B3.1~~-7(C-07)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				(>150°F general; >200°F local)			.CP-65 II.B3.2~~-8(C-07)~~ .CP-108
~~3~~M	~~BWR/PWR~~4	~~Concrete: dome; wall; basemat; ring girders; buttresses, Concrete: containment; wall; basemat, Concrete: basemat, concrete fill-in annulus~~BWR	~~Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)~~Steel elements (inaccessible areas): drywell shell; drywell head	~~A plant-specific aging management program is to be evaluated.~~Loss of material due to general, pitting, crevice corrosion	~~Yes, if temperature limits are exceeded (See subsection 3.5.2.2.1.2)~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.A1.CP-34~~ ~~II.B1~~Yes (SRP-SLR Section 3.5.2.~~CP-57~~ ~~II.B2.~~2.~~CP-57~~ ~~II.B3.~~1.~~CP-65~~ ~~II.B3.2.CP-108~~ 3.1)	~~II.A1-1(C-08)~~ ~~II.B1.2-3(C-35)~~ ~~II.B2.2-3(C-35)~~ II.B3.1~~-4(C-50)~~ ~~II.B3.2-2(C-33)~~ .CP-113
~~4~~M	~~BWR~~5	~~Steel elements (inaccessible areas): drywell shell; drywell head; and drywell shell~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel elements (inaccessible areas): liner; liner anchors; integral attachments, steel elements (inaccessible areas): suppression chamber; drywell; drywell head;	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of material due to general, pitting, crevice corrosion	~~Yes, if corrosion is indicated from the IWE examinations (See subsection 3.5.2.2.1.3.1)~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.B3.1.CP-113~~ Yes (SRP-SLR Section 3.5.2.2.1.3.1)	~~II.B3.1-8(C-19)~~ II.A1.CP-98 II.A2.CP-98 II.B1.2.CP-63 II.B2.1.CP-63 II.B2.2.C

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			embedded shell; region shielded by diaphragm floor (as applicable)				P-63 II.B3.2.CP-98
~~5~~M	~~BWR/PWR~~6	~~Steel elements (inaccessible areas): liner; liner anchors; integral attachments, Steel elements (inaccessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable)~~BWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel elements: torus shell	~~Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of material due to general, pitting, crevice corrosion	~~Yes, if corrosion is indicated from the IWE examinations (See subsection 3.5.2.2.1.3.1)~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.A1.CP-98~~ ~~II.A2.CP-98~~ ~~II.B1~~Yes (SRP-SLR Section 3.5.2.~~CP-63~~ ~~II.B2~~2.1.~~CP-63~~ ~~II.B2.2.CP-63~~ ~~II.B3~~3.2.~~CP-98~~)	~~II.A1-11(C-09)~~ ~~II.A2-9(C-09)~~ II.B1.~~2-8(C-46)~~ ~~II.B2.~~1~~-1(C-46)~~ ~~II.B2.2-10(C-46)~~ ~~II.B3.2-9(C-09)~~ .CP-48
~~6~~M	~~BWR~~7	~~Steel elements: torus shell~~BWR	~~Loss of material due to general, pitting, and crevice corrosion~~Steel elements: torus ring girders; downcomers;, Steel elements: suppression chamber shell (interior surface)	~~Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of material due to	~~Yes, if corrosion is significant Recoating of the torus is recommended. (See subsection 3.5.2.2.1.3.2)~~AMP XI.S1, "ASME	~~II.B1.1.CP-48~~ Yes (SRP-SLR Section 3.5.2.2.1.3.3)	II.B1.1~~-2(C-19)~~ .CP-109 II.B3.1.CP-158

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				general, pitting, crevice corrosion	Section XI, Subsection IWE"		
~~7~~M	~~BWR~~8	~~Steel elements: torus ring girders; downcomers;, Steel elements: suppression chamber shell (interior surface)~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Prestressing system: tendons	~~Chapter XI.S1, "ASME Section XI, Subsection IWE"~~Loss of prestress due to relaxation; shrinkage; creep; elevated temperature	~~Yes, if corrosion is significant (See subsection 3.5.2.2.1.3.3)~~TLAA, SRP-SLR Section 4.5, "Concrete Containment Tendon Prestress"	~~II.B1.1.CP-109~~ ~~II.B3.1.CP-158~~ Yes (SRP-SLR Section 3.5.2.2.1.4)	II.~~B1.1-2(~~A1.C-~~19)~~ 11 II.~~B3.1-8(~~B2.2.C-~~19)~~ 11
~~8~~M	~~BWR/PWR~~9	~~Prestressing system: tendons~~BWR/PWR	~~Loss of prestress due to relaxation; shrinkage; creep; elevated temperature~~Personnel airlock, equipment hatch, CRD hatch, penetration sleeves; penetration bellows, steel elements: torus; vent line; vent header; vent line bellows; downcomers, suppression pool shell; unbraced downcomers,	~~Yes, TLAA~~Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	~~Yes, TLAA (See subsection 3.5.2.2.1.4)~~TLAA, SRP-SLR Section 4.6, "Containment Liner Plate and Penetration Fatigue Analysis"	~~II.A1.C-11~~ ~~II.B2.2.C-11~~ Yes (SRP-SLR Section 3.5.2.2.1.5)	II.~~A1-9(~~A3.C-~~11)~~ 13 II.B1.1.C-21 II.B2.1.C-45 II.B2.2~~-8(~~.C-~~11)~~ 48 II.B4.C-13

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			steel elements: vent header; downcomers				
~~9~~M	~~BWR/PWR~~10	~~Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell; unbraced downcomers, Steel elements: vent header; downcomers~~BWR/PWR	~~Cumulative fatigue damage~~ ~~due to fatigue~~ ~~(Only if CLB fatigue analysis exists)~~Penetration sleeves; penetration bellows	~~Yes, TLAA~~Cracking due to stress corrosion cracking	~~Yes, TLAA (See subsection 3.5.2.2.1.5)~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.A3.C-13~~ ~~II.B1.1.C-21~~ ~~II.B2.1.C-45~~ ~~II.B2.2.C-48~~ ~~II.B4.C-13~~ Yes (SRP-SLR Section 3.5.2.2.1.6)	II.A3~~-4(C-13)~~ ~~II.B1.1-4(C-21)~~ ~~II.B2.1-4(C-45)~~ ~~II.B2.2-14(C-48)~~ .CP-38 II.B4~~-4(C-13)~~ .CP-38
~~10~~M	~~PWR~~11	~~Penetration sleeves; penetration bellows~~BWR/PWR	~~Cracking~~ ~~due to stress corrosion cracking~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and~~ ~~Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of material (spalling, scaling) and cracking due to freeze-thaw	~~Yes, detection of aging effects is to be evaluated (See subsection 3.5.2.2.1.6)~~Plant-specific aging management program	~~II.A3.CP-38~~ ~~II.B4.CP-38~~ Yes (SRP-SLR Section 3.5.2.2.1.7)	II.~~A3-2(C-15)~~ A1.CP-147 II.~~B4-2(C-15)~~ A2.CP-70 II.B3.2.CP-135

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~11~~M	~~BWR/PWR~~12	~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat~~BWR/PWR	~~Loss of material (spalling, scaling) and cracking due to freeze-thaw~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, containment, concrete fill-in annulus	~~Further evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).~~ Cracking due to expansion from reaction with aggregates	~~Yes, for plants located in moderate to severe weathering conditions (See subsection 3.5.2.2.1.7)~~Plant-specific aging management program	~~II.A1.CP-147 II.A2.CP-70 II.B3.2.CP-135~~ Yes (SRP-SLR Section 3.5.2.2.1.8)	II.A1~~-2(C-01)~~.CP-67 II.A2~~-~~.CP-104 II.B1.2.CP-99 II.B2.2~~(C-28)~~.CP-99 II.B3.1.CP-83 II.B3.2~~-3(C-29)~~.CP-121
~~12~~D	~~BWR/PWR~~13	~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): containment; wall; basemat, Concrete~~	~~Cracking due to expansion from reaction with aggregates~~	~~Further evaluation is required to determine if a plant-specific aging management program is needed.~~	~~Yes, if concrete is not constructed as stated function (See subsection 3.5.2.2.1.8)~~	~~II.A1.CP-67 II.A2.CP-104 II.B1.2.CP-99 II.B2.2.CP-99 II.B3.1.CP-83 II.B3.2.CP-121~~	~~II.A1-3(C-04) II.A2-3(C-38) II.B1.2-4(C-39) II.B2.2-4(C-39) II.B3.1-5(C-51)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~(inaccessible areas): basemat, concrete fill-in annulus~~					~~II.B3.2-4(C-40)~~
~~13~~M	~~BWR/PWR~~14	~~Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat~~BWR/PWR	~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, containment	~~Further evaluation is required to determine if a plant-specific aging management program is needed.~~ Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	~~Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.1.9)~~Plant-specific aging management program	~~II.A2.CP-53~~ ~~II.B3.1.CP-53~~ ~~II.B3.2.CP-122~~ Yes (SRP-SLR Section 3.5.2.2.1.9)	II.A1.CP-102 II.A2~~-6(C-30)~~.CP-53 II.B1.2.CP-110 II.B2.2.CP-110 II.B3.1~~-3(C-30)~~.CP-53 II.B3.2~~-6(C-32)~~.CP-122
~~14~~D	~~BWR/PWR~~15	~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas):~~	~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation~~	~~Further evaluation is required to determine if a plant-specific aging management program is needed.~~	~~Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.1.9)~~	~~II.A1.CP-102~~ ~~II.B1.2.CP-110~~ ~~II.B2.2.CP-110~~	~~II.A1-6(C-02)~~ ~~II.B1.2-6(C-31)~~ ~~II.B2.2-6(C-31)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~containment; wall; basemat~~					
~~15~~M	~~BWR/PWR~~16	~~Concrete (accessible areas): basemat~~BWR/PWR	~~Increase in porosity and permeability; loss of strength~~ ~~due to leaching of calcium hydroxide and carbonation~~Concrete (accessible areas): basemat, concrete: containment; wall	~~Chapter XI.S2, "ASME Section XI, Subsection IWL"~~Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL," and/or AMP XI.S6, "Structures Monitoring"	~~II.A2.CP-155~~ ~~II.B3.1.CP-156~~ No	II.A1.CP-87 II.A2~~-6(C-30)~~.CP-72 II.B1.2.CP-106 II.B2.2.CP-106 II.B3.1~~-3(C-30)~~.CP-72
~~16~~D	~~BWR/PWR~~17	~~Concrete (accessible areas): basemat, Concrete: containment; wall; basemat~~	~~Increase in porosity and permeability; cracking; loss of material (spalling, scaling)~~ ~~due to aggressive chemical attack~~	~~Chapter XI.S2, "ASME Section XI, Subsection IWL," or~~ ~~Chapter XI.S6, "Structures Monitoring"~~	~~No~~	~~II.A2.CP-72~~ ~~II.B1.2.CP-106~~ ~~II.B2.2.CP-106~~ ~~II.B3.1.CP-72~~	~~II.A2-4(C-25)~~ ~~II.B1.2-5(C-26)~~ ~~II.B2.2-5(C-26)~~ ~~II.B3.1-1(C-25)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~17~~M	~~BWR~~18	~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses~~BWR/PWR	~~Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses	~~Chapter XI.S2, "ASME Section XI, Subsection IWL"~~Loss of material (spalling, scaling) and cracking due to freeze-thaw	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL" and/or AMP XI.S6, "Structures Monitoring"	~~II.A1.CP-87~~ No	II.A1~~-4(C-03)~~ .CP-31 II.A2.CP-51 II.B3.2.CP-52
~~18~~M	~~BWR/PWR~~19	~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat~~BWR/PWR	~~Loss of material (spalling, scaling) and cracking due to freeze-thaw~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, containment; concrete fill-in annulus	~~Chapter XI.S2, "ASME Section XI, Subsection IWL"~~Cracking due to expansion from reaction with aggregates	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL" and/or AMP XI.S6, "Structures Monitoring"	~~II.A1.CP-31~~ ~~II.A2.CP-51~~ ~~II.B3.2.CP-52~~ No	II.A1~~-2(C-01)~~ .CP-33 II.A2~~-~~ .CP-58 II.B1.2.CP-59 II.B2.2~~(C-28)~~ .CP-59 II.B3.1.CP-66 II.B3.2~~-3(C-29)~~ .CP-60

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~19~~M	~~BWR/PWR~~20	~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat, Concrete (accessible areas): containment; wall; basemat, Concrete (accessible areas): basemat, concrete fill-in annulus~~BWR/PWR	~~Cracking due to expansion from reaction with aggregates~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, containment	~~Chapter XI.S2, "ASME Section XI, Subsection IWL"~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL"	~~II.A1.CP-33~~ ~~II.A2.CP-58~~ ~~II.B1.2.CP-59~~ ~~II.B2.2.CP-59~~ ~~II.B3.1.CP-66~~ ~~II.B3.2.CP-60~~ No	II.A1~~-3(C-04)~~.CP-32 II.A2~~-3(C-38)~~.CP-155 II.B1.2~~-4(C-39)~~.CP-54 II.B2.2~~-4(C-39)~~.CP-54 II.B3.1~~-5(C-51)~~.CP-156 II.B3.2~~-4(C-40)~~.CP-55
~~20~~M	~~BWR/PWR~~21	~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): containment; wall;~~	~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation~~Concrete (accessible areas):	~~Chapter XI.S2, "ASME Section XI, Subsection IWL"~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL" and/or AMP XI.S6, "Structures Monitoring"	~~II.A1.CP-32~~ ~~II.B1.2.CP-54~~ ~~II.B2.2.CP-54~~ ~~II.B3.2.CP-55~~ No	II.A1~~-6(C-02)~~.CP-68 II.A2.CP-74

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-~~SLR~~ Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~basemat~~BWR/PWR	dome; wall; basemat; ring girders; buttresses; reinforcing steel				II.B1.2~~-6(C-31)~~ .CP-79 II.B2.2~~-6(C-31)~~ .CP-79 II.B3.1.CP-74 II.B3.2~~-6(C-32)~~ .CP-88
~~21~~D	~~BWR/PWR~~22	~~Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel, Concrete (accessible areas): basemat; reinforcing steel, Concrete (accessible areas): dome; wall; basemat; reinforcing steel~~	~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel~~	~~Chapter XI.S2, "ASME Section XI, Subsection IWL"~~	~~No~~	~~II.A1.CP-68 II.A2.CP-74 II.B1.2.CP-79 II.B2.2.CP-79 II.B3.1.CP-74 II.B3.2.CP-88~~	~~II.A1-7(C-05) II.A2-7(C-43) II.B1.2-2(C-41) II.B2.2-2(C-41) II.B3.1-6(C-43) II.B3.2-7(C-42)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~22~~M	~~BWR~~23	~~Concrete (inaccessible areas): basemat; reinforcing steel~~BWR/PWR	~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel~~Concrete (inaccessible areas): basemat; reinforcing steel, dome; wall	~~Chapter XI.S6, "Structures Monitoring"~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL," and/or AMP XI.S6, "Structures Monitoring"	~~II.B1.2.CP-80~~ ~~II.B2.2.CP-80~~ No	II.A1.CP-97 II.A2.CP-75 II.B1.2~~(C-41)~~ .CP-80 II.B2.2~~-~~.CP-80 II.B3.1.CP-75 II.B3.2~~(C-41)~~ .CP-89
~~23~~M	~~BWR/PWR~~24	~~Concrete (inaccessible areas): basemat; reinforcing steel, Concrete (inaccessible areas): dome; wall; basemat; reinforcing steel~~BWR/PWR	~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, concrete (accessible areas): dome; wall; basemat	~~Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"~~Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL," and/or AMP XI.S6, "Structures Monitoring"	~~II.A2.CP-75~~ ~~II.B3.1.CP-75~~ ~~II.B3.2.CP-89~~ No	II.A1.CP-100 II.A2~~-7(C-43)~~ .CP-71 II.B3.1~~-6(C-43)~~ .CP-71 II.B3.2~~-7(C-42)~~ .CP-73 II.B3.2.CP-84

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~24~~D	~~BWR/PWR~~25	~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (accessible areas): dome; wall; basemat~~	~~Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack~~	~~Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"~~	~~No~~	~~II.A1.CP-100~~ ~~II.A2.CP-71~~ ~~II.B3.1.CP-71~~ ~~II.B3.2.CP-73~~ ~~II.B3.2.CP-84~~	~~II.A1-4(C-03)~~ ~~II.A2-4(C-25)~~ ~~II.B3.1-1(C-25)~~ ~~II.B3.2-5(C-27)~~ ~~II.B3.2-5(C-27)~~
~~25~~	~~PWR~~26	~~Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel~~BWR/PWR	~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel~~Moisture barriers (caulking, flashing, and other sealants)	~~Chapter XI.S2, "ASME Section XI, Subsection IWL," or Chapter XI.S6, "Structures Monitoring"~~Loss of sealing due to wear, damage, erosion, tear, surface cracks, other defects	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE"	~~II.A1.CP-97~~ No	II.~~A1-7(C-05)~~ A3.CP-40 II.B4.CP-40
~~26~~	~~BWR/PWR~~27	~~Moisture barriers (caulking, flashing, and other sealants)~~BWR/PWR	~~Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other~~	~~Chapter XI.S1, "ASME Section XI, Subsection IWE"~~Cracking due to cyclic loading (CLB	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR	~~II.A3.CP-40~~ ~~II.B4.CP-40~~ No	II.A3~~-7(C-18)~~ .CP-37 II.B1.1.CP-49

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			~~defects~~Penetration sleeves; penetration bellows, steel elements: torus; vent line; vent header; vent line bellows; downcomers, suppression pool shell	fatigue analysis does not exist)	Part 50, Appendix J"		II.B2.1.CP-107 II.B4~~-7(C-18)~~ .CP-37
~~27~~	~~BWR/PWR~~28	~~penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell~~BWR/PWR	~~Cracking due to cyclic loading (CLB fatigue analysis does not exist)~~Personnel airlock, equipment hatch, CRD hatch	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.A3.CP-37~~ ~~II.B1.1.CP-49~~ ~~II.B2.1.CP-107~~ ~~II.B4.CP-37~~ No	II.A3~~-3(~~.C-~~14)~~ ~~II.B1.1-3(C-20)~~ ~~II.B2.1-3(C-44)~~ 16 II.B4~~-3(~~.C-~~14)~~ 16
~~28~~M	~~BWR/PWR~~29	~~Personnel airlock, equipment hatch, CRD hatch~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Personnel airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of leak tightness due to mechanical wear	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.A3.C-16~~ ~~II.B4.C-16~~ No	II.A3~~-6(C-16)~~ .CP-39 II.B4~~-6(C-16)~~ .CP-39

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~29~~	~~BWR/PWR~~30	~~Personnel airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms~~BWR/PWR	~~Loss of leak tightness due to mechanical wear of locks, hinges and closure mechanisms~~Pressure-retaining bolting	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of preload due to self-loosening	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.A3.CP-39~~ ~~II.B4.CP-39~~ No	II.A3~~-5(C-17)~~.CP-150 II.B4~~-5(C-17)~~.CP-150
~~30~~	~~BWR/PWR~~31	~~Pressure-retaining bolting~~BWR/PWR	~~Loss of preload due to self-loosening~~Pressure-retaining bolting, steel elements: downcomer pipes	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE"	~~II.A3.CP-150~~ ~~II.B4.CP-150~~ No	~~N/A~~ ~~N/A~~ II.A3.CP-148 II.B1.2.CP-117 II.B2.1.CP-117 II.B2.2.CP-117 II.B4.CP-148
~~31~~	~~BWR/PWR~~32	~~Pressure-retaining bolting, Steel elements: downcomer pipes~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Prestressing system: tendons; anchorage components	~~Chapter XI.S1, "ASME Section XI, Subsection IWE"~~Loss of material due to corrosion	~~No~~AMP XI.S2, "ASME Section XI, Subsection IWL"	~~II.A3.CP-148~~ ~~II.B1.2.CP-117~~ ~~II.B2.1.CP-117~~ ~~II.B2.2.CP-117~~ ~~II.B4.CP-148~~	~~N/A~~ II.~~B1.2-8(~~A1.C-~~46)~~10 II.B2.~~1-1(~~2.C-~~46)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						No	~~II.B2.2-~~ 10~~(C-46)~~ ~~N/A~~
~~32~~	~~BWR/PWR~~33	~~Prestressing system: tendons; anchorage components~~BWR/PWR	~~Loss of material due to corrosion~~Seals and gaskets	~~Chapter XI.S2, "ASME Section XI, Subsection IWL"~~Loss of sealing due to wear, damage, erosion, tear, surface cracks, other defects	~~No~~AMP XI.S4, "10 CFR Part 50, Appendix J "	~~II.A1.C-10~~ ~~II.B2.2.C-10~~ No	II.~~A1-10(C-10)~~ A3.CP-41 II.~~B2.2-9(C-10)~~ B4.CP-41
~~33~~	~~BWR/PWR~~34	~~Seals and gaskets~~BWR/PWR	~~Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects~~Service Level I coatings	~~Chapter XI.S4, "10 CFR Part 50, Appendix J "~~Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	~~No~~AMP XI.S8, "Protective Coating Monitoring and Maintenance"	~~II.A3.CP-41~~ ~~II.B4.CP-41~~ No	II.A3~~-7(C-18)~~ .CP-152 II.B4~~-7(C-18)~~ .CP-152
~~34~~M	~~BWR/PWR~~35	~~Service Level I coatings~~BWR/PWR	~~Loss of coating integrity due to blistering, cracking, flaking, peeling, or physical damage~~Steel elements	~~Chapter XI.S8, "Protective Coating Monitoring and Maintenance"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.A3.CP-152~~ ~~II.B4.CP-152~~ No	~~N/A~~ ~~N/A~~ II.A1.CP-35 II.A2.CP-

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			(accessible areas): liner; liner anchors; integral attachments, penetration sleeves, drywell shell; drywell head; drywell shell in sand pocket regions; suppression chamber; drywell; embedded shell; region shielded by diaphragm floor (as applicable)				35 II.A3.CP-36 II.B1.1.CP-43 II.B1.2.CP-46 II.B2.1.CP-46 II.B2.2.CP-46 II.B3.1.CP-43 II.B3.2.CP-35 II.B4.CP-36
~~35~~M	~~BWR/PWR~~36	~~Steel elements (accessible areas): liner; liner anchors; integral attachments, Penetration sleeves, Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket regions;, Steel~~	~~Loss of material due to general, pitting, and crevice corrosion~~Steel elements: drywell head; downcomers	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Loss of material due to mechanical wear, including fretting	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE"	~~II.A1.CP-35~~ ~~II.A2.CP-35~~ ~~II.A3.CP-36~~ ~~II.B1.1.CP-43~~ ~~II.B1.2.CP-46~~ ~~II.B2.1.CP-46~~ ~~II.B2.2.CP-46~~	~~II.A1-11(C-09)~~ ~~II.A2-9(C-09)~~ ~~II.A3-1(C-12)~~ II.B1.1~~-2(~~.C-~~19)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~elements (accessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable), Steel elements (accessible areas): drywell shell; drywell head~~BWR				~~II.B3.1.CP-43~~ ~~II.B3.2.CP-35~~ ~~II.B4.CP-36~~ No	23 II.B1.2~~-8(~~.C-~~46)~~ 23 II.B2.1~~-1(~~.C-~~46)~~ 23 II.B2.2~~-10(~~.C-~~46)~~ ~~II.B3.1-8(C-19)~~ ~~II.B3.2-9(C-09)~~ ~~II.B4-1(C-12)~~ 23
~~36~~	~~BWR~~37	~~Steel elements: drywell head; downcomers~~BWR	~~Fretting or lockup due to mechanical wear~~Steel elements: suppression chamber (torus) liner (interior surface)	~~Chapter XI.S1, "ASME Section XI, Subsection IWE"~~Loss of material due to general (steel only), pitting, crevice corrosion	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.B1.1.C-23~~ ~~II.B1.2.C-23~~ ~~II.B2.1.C-23~~ ~~II.B2.2.C-23~~ No	~~II.B1.1-1(C-23)~~ II.B1.2~~-9(~~.C-~~23)~~ 49 II.B2.~~1-~~2~~(~~.C-~~23)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~II.B2.2-11(C-23)~~ 49
~~37~~	~~BWR~~38	~~Steel elements: suppression chamber (torus) liner (interior surface)~~BWR	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~Steel elements: suppression chamber shell (interior surface)	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.B1.2.C-49~~ ~~II.B2.2.C-49~~ No	II.~~B1.2-10(~~B3.1.C-~~49)~~ 24 II.~~B2~~B3.2~~-12(~~.C-~~49)~~ 24
~~38~~	~~BWR~~39	~~Steel elements: suppression chamber shell (interior surface)~~BWR	~~Cracking due to stress corrosion cracking~~Steel elements: vent line bellows	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J"	~~II.B3.1.C-24~~ ~~II.B3.2.C-24~~ No	II.~~B3~~B1.1~~-9(C-24)~~ ~~II.B3.2-10(C-24)~~ .CP-50
~~39~~	~~BWR~~40	~~Steel elements: vent line bellows~~BWR	~~Cracking due to stress corrosion cracking~~Unbraced downcomers, steel elements: vent header; downcomers	~~Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"~~Cracking due to cyclic loading	~~No~~AMP XI.S1, "ASME Section XI, Subsection IWE"	~~II.B1.1.CP-50~~ No	II.~~B1~~B2.1~~-5(C-22)~~ .CP-142 II.B2.2.CP-64

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				(CLB fatigue analysis does not exist)			
~~40~~M	~~BWR~~41	~~Unbraced downcomers, Steel elements: vent header; downcomers~~BWR	~~Cracking due to cyclic loading (CLB fatigue analysis does not exist)~~Steel elements: drywell support skirt, steel elements (inaccessible areas): support skirt	~~Chapter XI.S1, "ASME Section XI, Subsection IWE"~~None	~~No~~None	~~II.B2.1.CP-142~~ ~~II.B2.2.CP-64~~ No	II.B1.1.CP-44 II.B1.2.CP-114 II.B2.1~~-3(C-44)~~.CP-114 II.B2.2~~-13(C-47)~~.CP-114
~~41~~M	~~BWR~~42	~~Steel elements: drywell support skirt, Steel elements (inaccessible areas): support skirt~~BWR/PWR	~~None~~Groups 1-3, 5, 7-9: concrete (inaccessible areas): foundation	~~None~~Loss of material (spalling, scaling) and cracking due to freeze-thaw	~~NA - No AEM or AMP~~Plant-specific aging management program	~~II.B1.1.CP-44~~ ~~II.B1~~Yes (SRP-SLR Section 3.5.2.~~CP-114~~ ~~II.B2.1.CP-114~~ ~~II.B2.~~2.~~CP-114~~ 2.1.1)	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ III.A1.TP-108 III.A2.TP-108 III.A3.TP-108 III.A5.TP-108

Table 3.5-1.~~.~~ Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							III.A7.TP-108 III.A8.TP-108 III.A9.TP-108
~~Safety-Related and Other Structures; and Component Supports~~ M	43	BWR/PWR	All Groups except Group 6: concrete (inaccessible areas): all	Cracking due to expansion from reaction with aggregates	Plant-specific aging management program	Yes (SRP-SLR Section 3.5.2.2.2.1.2)	III.A1.TP-204 III.A2.TP-204 III.A3.TP-204 III.A4.TP-204 III.A5.TP-204 III.A7.TP-204 III.A8.TP-204 III.A9.TP-204
~~42~~M	~~BWR/PWR~~44	~~Groups 1-3, 5, 7-9:Concrete (inaccessible areas): foundation~~BWR/PWR	~~Loss of material (spalling, scaling) and cracking due to freeze-thaw~~All Groups: concrete: all	~~Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)~~Cracking and	~~Yes, for plants located in moderate to severe weathering conditions (See subsection 3.5.2.2.2.1.1)~~AMP XI.S6,	~~III.A1.TP-108 III.A2.TP-108 III.A3.TP-108 III.A5.TP-108 III.A7.TP-108~~	III.A1~~-6(T-01)~~ .TP-30 III.A2~~-6(T-01)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				distortion due to increased stress levels from settlement	"Structures Monitoring"	~~III.A8.TP-108~~ ~~III.A9.TP-108~~ Yes (SRP-SLR Section 3.5.2.2.2.1.3)	.TP-30 III.A3~~-6(T-01)~~ .TP-30 III.A4.TP-304 III.A5~~-6(T-01)~~ .TP-30 III.A6.TP-30 III.A7~~-5(T-01)~~ .TP-30 III.A8~~-5(T-01)~~ .TP-30 III.A9~~-5(T-01)~~ .TP-30
~~43~~D	~~BWR/PWR~~45	~~All Groups except Group 6:Concrete (inaccessible areas): all~~	~~Cracking due to expansion from reaction with aggregates~~	~~Further evaluation is required to determine if a plant-specific aging management program is needed.~~	~~Yes, if concrete is not constructed as stated (See subsection 3.5.2.2.2.1.2)~~	~~III.A1.TP-204~~ ~~III.A2.TP-204~~ ~~III.A3.TP-204~~	~~III.A1-2(T-03)~~ ~~III.A2-2(T-03)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~III.A4.TP-204~~ ~~III.A5.TP-204~~ ~~III.A7.TP-204~~ ~~III.A8.TP-204~~ ~~III.A9.TP-204~~	~~III.A3-2(T-03)~~ ~~III.A4-2(T-03)~~ ~~III.A5-2(T-03)~~ ~~III.A7-1(T-03)~~ ~~III.A8-1(T-03)~~ ~~III.A9-1(T-03)~~
~~44~~M	~~BWR/PWR~~46	~~All Groups: concrete: all~~BWR/PWR	~~Cracking and distortion due to increased stress levels from settlement~~Groups 1-3, 5-9: concrete: foundation; subfoundation	~~Chapter XI.S6, "Structures Monitoring"~~ ~~If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended~~	~~Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.2.1.3)~~AMP XI.S6, "Structures Monitoring"	~~III.A1.TP-30~~ ~~III.A2.TP-30~~ ~~III.A3.TP-30~~ ~~III.A4.TP-304~~ ~~III.A5.TP-30~~ ~~III.A6.TP-30~~ ~~III.A7.TP-30~~	III.A1~~-3(T-08)~~.TP-31 III.A2~~-3(T-08)~~.TP-31 III.A3~~-3(T-08)~~ ~~N/A~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~operation.~~Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation		~~III.A8.TP-30~~ ~~III.A9.TP-30~~ Yes (SRP-SLR Section 3.5.2.2.2.1.3)	.TP-31 III.A5~~-3(T-08)~~ .TP-31 III.A6~~-4(T-08)~~ .TP-31 III.A7~~-2(T-08)~~ .TP-31 III.A8~~-2(T-08)~~ .TP-31 III.A9~~-2(T-08)~~ .TP-31
~~45~~M	~~BWR~~47	~~Groups 1-3, 5-9: concrete: foundation; subfoundation~~BWR/PWR	~~Reduction in foundation strength, cracking due to differential settlement,erosion of porous concrete subfoundation~~Groups 1-5, 7-9: concrete (inaccessible areas): exterior above- and below-grade; foundation	~~Chapter XI.S6, "Structures Monitoring"~~ ~~If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of~~	~~Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.2.1.3)~~Plant-specific aging management program	~~III.A9.TP-31~~ Yes (SRP-SLR Section 3.5.2.2.2.1.4)	~~III.A9-7(T-09)~~ III.A1.TP-67 III.A2.TP-67 III.A3.TP-67 III.A4.TP-305

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~the de-watering system through the period of extended operation.~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation			III.A5.TP-67 III.A7.TP-67 III.A8.TP-67 III.A9.TP-67
~~46~~M	~~BWR/PWR~~48	~~Groups 1-3, 5-9: concrete: foundation; subfoundation~~BWR/PWR	~~Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation~~Groups 1-5: concrete: all	~~Chapter XI.S6, "Structures Monitoring"~~ ~~If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.~~Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	~~Yes, if a de-watering system is relied upon to control settlement (See subsection 3.5.2.2.2.1.3)~~Plant-specific aging management program	~~III.A1.TP-31~~ ~~III.A2.TP-31~~ ~~III.A3.TP-31~~ ~~III.A5.TP-31~~ ~~III.A6.TP-31~~ ~~III.A7.TP-31~~ ~~III.A8.TP-31~~ Yes (SRP-SLR Section 3.5.2.2.2.2)	III.A1~~-8(T-09)~~.TP-114 III.A2~~-8(T-09)~~.TP-114 III.A3~~-8(T-09)~~.TP-114 III.A4.TP-114 III.A5~~-8(T-09)~~ ~~III.A6-8(T-09)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~III.A7-7(T-09)~~ ~~III.A8-7(T-09)~~ .TP-114
~~47~~M	~~BWR/PWR~~49	~~Groups 1-5, 7-9: concrete (inaccessible areas): exterior above- and below-grade; foundation~~BWR/PWR	~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation~~Groups 6 - concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	~~Further evaluation is required to determine if a plant-specific aging management program is needed.~~Loss of material (spalling, scaling) and cracking due to freeze-thaw	~~Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.2.1.4)~~Plant-specific aging management program	~~III.A1.TP-67~~ ~~III.A2.TP-67~~ ~~III.A3.TP-67~~ ~~III.A4.TP-305~~ ~~III.A5.TP-67~~ ~~III.A7.TP-67~~ ~~III.A8.TP-67~~ ~~III.A9.TP-67~~ Yes (SRP-SLR Section 3.5.2.2.2.3.1)	III.~~A1-7(T-02)~~ ~~III.A2-7(T-02)~~ ~~III.A3-7(T-02)~~ ~~N/A~~ ~~III.A5-7(T-02)~~ ~~III.A7-6(T-02)~~ ~~III.A8-6(T-02)~~ ~~III.A9-6(T-02)~~ A6.TP-110

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~48~~M	~~BWR/PWR~~50	~~Groups 1-5: concrete: all~~BWR/PWR	~~Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)~~Groups 6: concrete (inaccessible areas): all	~~A plant-specific aging management program is to be evaluated.~~Cracking due to expansion from reaction with aggregates	~~Yes, if temperature limits are exceeded (See subsection 3.5.2.2.2.2)~~Plant-specific aging management program	~~III.A1.TP-114~~ ~~III.A2.TP-114~~ ~~III.A3.TP-114~~ ~~III.A4.TP-114~~ ~~III.A5.TP-114~~ Yes (SRP-SLR Section 3.5.2.2.2.3.2)	III.~~A1-1(T-10)~~ ~~III.A2-1(T-10)~~ ~~III.A3-1(T-10)~~ ~~III.A4-1(T-10)~~ ~~III.A5-1(T-10)~~ A6.TP-220
~~49~~M	~~BWR/PWR~~51	~~Groups 6 - concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab~~BWR/PWR	~~Loss of material (spalling, scaling) and cracking due to freeze-thaw~~Groups 6: concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab	~~Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	~~Yes, for plants located in moderate to severe weathering conditions (See subsection 3.5.2.2.2.3.1)~~Plant-specific aging management program	~~III.A6.TP-110~~ Yes (SRP-SLR Section 3.5.2.2.2.3.3)	III.A6~~-5(T-15)~~ .TP-109

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL~~-~~SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~50~~M	~~BWR/PWR~~52	~~Groups 6: concrete (inaccessible areas): all~~BWR/PWR	~~Cracking due to expansion from reaction with aggregates~~Groups 7, 8 - steel components: tank liner	~~Further evaluation is required to determine if a plant-specific aging management program is needed.~~Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	~~Yes, if concrete is not constructed as stated See subsection 3.5.2.2.2.3.2)~~Plant-specific aging management program	~~III.A6.TP-220~~ Yes (SRP-SLR Section 3.5.2.2.2.4)	III.~~A6-2(~~A7.T-~~17)~~ 23 III.A8.T-23
~~51~~M	~~BWR/PWR~~53	~~Groups 6: concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab~~BWR/PWR	~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation~~Support members; welds; bolted connections; support anchorage to building structure	~~Further evaluation is required to determine if a plant-specific aging management program is needed.~~Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	~~Yes, if leaching is observed in accessible areas that impact intended function (See subsection 3.5.2.2.2.3.3)~~TLAA, SRP-SLR Section 4.3 "Metal Fatigue"	~~III.A6.TP-109~~ Yes (SRP-SLR Section 3.5.2.2.2.5)	III.~~A6-6(~~B1.1.T-~~16)~~ 26 III.B1.2.T-26 III.B1.3.T-26
~~52~~	~~BWR/PWR~~54	~~Groups 7, 8 - steel components: tank liner~~BWR/PWR	~~Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion~~All groups except 6:	~~A plant-specific aging management program is to be evaluated.~~Cracking due to expansion from reaction with aggregates	~~Yes, plant-specific (See subsection 3.5.2.2.2.4)~~AMP XI.S6, "Structures Monitoring"	~~III.A7.T-23~~ ~~III.A8.T-23~~ No	~~III.A7-11(T-23)~~ ~~III.A8-9(T-23)~~ III.A1.TP-25 III.A2.TP-25 III.A3.TP-25

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			concrete (accessible areas): all				III.A4.TP-25 III.A5.TP-25 III.A7.TP-25 III.A8.TP-25 III.A9.TP-25
~~53~~M	~~BWR/PWR~~55	~~Support members; welds; bolted connections; support anchorage to building structure~~BWR/PWR	~~Cumulative fatigue damage~~ ~~due to fatigue~~ ~~(Only if CLB fatigue analysis exists)~~Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	~~Yes, TLAA~~Reduction in concrete anchor capacity due to local concrete degradation/ service- induced cracking or other concrete aging mechanisms	~~Yes, TLAA (See subsection 3.5.2.2.2.5)~~AMP XI.S6, "Structures Monitoring"	~~III.B1.1.T-26~~ ~~III.B1.2.T-26~~ ~~III.B1.3.T-26~~ No	III.B1.1~~-12(T-26)~~.TP-42 III.B1.2~~-9(T-26)~~.TP-42 III.B1.3~~-9(T-26)~~.TP-42 III.B2.TP-42 III.B3.TP-42 III.B4.TP-42
~~54~~M	~~BWR/PWR~~56	~~All groups except 6: concrete~~	~~Cracking~~	~~Chapter XI.S6, "Structures Monitoring"~~Loss of	~~No~~AMP XI.S7, "Inspection of Water-Control	~~III.A1.TP-25~~ ~~III.A2.TP-25~~	III.~~A1-2(~~A6.T-~~03)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~(accessible areas): all~~BWR/PWR	~~due to expansion from reaction with aggregates~~Concrete: exterior above- and below- grade; foundation; interior slab	material due to abrasion; cavitation	Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	~~III.A3.TP-25~~ ~~III.A4.TP-25~~ ~~III.A5.TP-25~~ ~~III.A7.TP-25~~ ~~III.A8.TP-25~~ ~~III.A9.TP-25~~ No	~~III.A2-2(T-03)~~ ~~III.A3-2(T-03)~~ ~~III.A4-2(T-03)~~ ~~III.A5-2(T-03)~~ ~~III.A7-1(T-03)~~ ~~III.A8-1(T-03)~~ ~~III.A9-1(T-03)~~ 20
~~55~~M	~~BWR/PWR~~57	~~Building concrete at locations of expansion and grouted anchors; grout pads for support base plates~~BWR/PWR	~~Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms~~Constant and variable load spring hangers; guides; stops	~~Chapter XI.S6, "Structures Monitoring"~~Loss of mechanical function due to corrosion, distortion, dirt or debris accumulation, overload, wear	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.B1.1.TP-42~~ ~~III.B1.2.TP-42~~ ~~III.B1.3.TP-42~~ ~~III.B2.TP-42~~ ~~III.B3.TP-42~~ ~~III.B4.TP-42~~	III.B1.1~~-1(~~.T-~~29)~~28 III.B1.2~~-1(~~.T-~~29)~~28 III.B1.3~~-1(~~.T-~~29)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~III.B5.TP-42~~ No	~~III.B2-1(T-29)~~ ~~III.B3-1(T-29)~~ ~~III.B4-1(T-29)~~ ~~III.B5-1(T-29)~~ 28
~~56~~M	~~BWR/PWR~~58	~~Concrete: exterior above- and below-grade; foundation; interior slab~~BWR/PWR	~~Loss of material due to abrasion; cavitation~~Earthen water-control structures: dams; embankments; reservoirs; channels; canals and ponds	~~Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.~~Loss of material; loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage	~~No~~AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	~~III.A6.T-20~~ No	III.A6~~-7(~~.T-~~20)~~ 22

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~57~~M	~~BWR/PWR~~59	~~Constant and variable load spring hangers; guides; stops~~BWR/PWR	~~Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads~~Group 6: concrete (accessible areas): all	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	~~No~~AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	~~III.B1.1.T-28~~ ~~III.B1.2.T-28~~ ~~III.B1.3.T-28~~ No	III.~~B1.1-2(T-28)~~ ~~III.B1.2-2(T-28)~~ ~~III.B1.3-2(T-28)~~ A6.TP-38
~~58~~M	~~BWR/PWR~~60	~~Earthen water-control structures: dams; embankments; reservoirs; channels; canals and ponds~~BWR/PWR	~~Loss of material; loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage~~Group 6: concrete (accessible areas): exterior above- and below-grade; foundation	~~Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.~~Loss of material (spalling, scaling) and cracking due to freeze-thaw	~~No~~AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	~~III.A6.T-22~~ No	III.A6~~-9(T-22)~~ .TP-36

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~59~~M	~~BWR/PWR~~61	~~Group 6: concrete (accessible areas): all~~BWR/PWR	~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel~~Group 6: concrete (accessible areas): exterior above- and below-grade; foundation; interior slab	~~Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	~~No~~AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	~~III.A6.TP-38~~ No	III.A6~~-1(T-18)~~ .TP-37
~~60~~M	~~BWR/PWR~~62	~~Group 6: concrete (accessible areas): exterior above- and below-grade; foundation~~BWR/PWR	~~Loss of material (spalling, scaling) and cracking due to freeze-thaw~~Group 6: Wooden Piles; sheeting	~~Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.~~Loss of material; change in	~~No~~AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	~~III.A6.TP-36~~ No	III.A6~~-5(T-15)~~ .TP-223

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				material properties due to weathering, chemical degradation, and insect infestation repeated wetting and drying, fungal decay			
~~61~~	~~BWR/PWR~~63	~~Group 6: concrete (accessible areas): exterior above- and below-grade; foundation; interior slab~~BWR/PWR	~~Increase in porosity and permeability; loss of strength~~ ~~due to leaching of calcium hydroxide and carbonation~~Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation	~~Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A6.TP-37~~ No	~~III.A6-6(T-16)~~ III.A1.TP-24 III.A2.TP-24 III.A3.TP-24 III.A5.TP-24 III.A7.TP-24 III.A8.TP-24 III.A9.TP-24
~~62~~	~~BWR/PWR~~64	~~Group 6: Wooden Piles; sheeting~~BWR/PWR	~~Loss of material; change in material properties~~ ~~due to weathering, chemical degradation, and insect infestation repeated wetting and~~	~~Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the~~	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A6.TP-223~~ No	~~N/A~~ III.A1.TP-23 III.A2.TP-23 III.A3.TP-

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			~~drying, fungal decay~~Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation	~~FERC/US Army Corp of Engineers dam inspections and maintenance programs.~~Loss of material (spalling, scaling) and cracking due to freeze-thaw			23 III.A5.TP-23 III.A7.TP-23 III.A8.TP-23 III.A9.TP-23
~~63~~	~~BWR/PWR~~65	~~Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation~~BWR/PWR	~~Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation~~Groups 1-3, 5, 7-9: concrete (inaccessible areas): below-grade exterior; foundation, Groups 1-3, 5, 7-9: concrete (accessible areas): below-grade exterior; foundation, Groups 6: concrete (inaccessible areas): all	~~Chapter XI.S6, "Structures Monitoring"~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A1.TP-24 III.A2.TP-24 III.A3.TP-24 III.A5.TP-24 III.A7.TP-24 III.A8.TP-24 III.A9.TP-24~~ No	III.A1~~-7(T-02)~~.TP-212 III.A1.TP-27 III.A2~~-7(T-02)~~.TP-212 III.A2.TP-27 III.A3~~-7(T-02)~~.TP-212 III.A3.TP-27 III.A5~~-7(T-02)~~.TP-212 III.A5.TP-

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							27 III.A6.TP-104 III.A7~~-6(T-02)~~ .TP-212 III.A7.TP-27 III.A8~~-6(T-02)~~ .TP-212 III.A8.TP-27 III.A9~~-6(T-02)~~ .TP-212 III.A9.TP-27
~~64~~	~~BWR/PWR~~66	~~Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation~~BWR/PWR	~~Loss of material (spalling, scaling) and cracking~~ ~~due to freeze-thaw~~Groups 1-5, 7, 9: concrete (accessible areas): interior and above-grade exterior	~~Chapter XI.S6, "Structures Monitoring"~~Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A1.TP-23~~ ~~III.A2.TP-23~~ ~~III.A3.TP-23~~ ~~III.A5.TP-23~~ ~~III.A7.TP-23~~	III.A1~~-6(T-01)~~ .TP-26 III.A2~~-6(T-01)~~ .TP-26 III.A3~~-6(T-01)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~III.A8.TP-23~~ ~~III.A9.TP-23~~ No	.TP-26 III.A4.TP-26 III.A5~~-6(T-01)~~ .TP-26 III.A7~~-5(T-01)~~ ~~III.A8-5(T-01)~~ .TP-26 III.A9~~-5(T-01)~~ .TP-26
~~65~~	~~BWR/PWR~~67	~~Groups 1-3, 5, 7-9: concrete (inaccessible areas): below-grade exterior; foundation, Groups 1-3, 5, 7-9: concrete (accessible areas): below-grade exterior; foundation, Groups 6: concrete (inaccessible~~	~~Cracking; loss of bond; and loss of material (spalling, scaling)~~ ~~due to corrosion of embedded steel~~Groups 1-5, 7, 9: Concrete: interior; above-grade exterior, Groups 1-3, 5, 7-9 - concrete (inaccessible areas): below-grade exterior; foundation, Group 6:	~~Chapter XI.S6, "Structures Monitoring"~~Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A1.TP-212~~ ~~III.A1.TP-27~~ ~~III.A2.TP-212~~ ~~III.A2.TP-27~~ ~~III.A3.TP-212~~ ~~III.A3.TP-27~~ ~~III.A5.TP-212~~	III.A1~~-4(T-05)~~ .TP-28 III.A1~~-4(T-05)~~ .TP-29 III.A2~~-4(T-05)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~areas): all~~BWR/PWR	concrete (inaccessible areas): all			~~III.A5.TP-27~~ ~~III.A6.TP-104~~ ~~III.A7.TP-212~~ ~~III.A7.TP-27~~ ~~III.A8.TP-212~~ ~~III.A8.TP-27~~ ~~III.A9.TP-212~~ ~~III.A9.TP-27~~ No	.TP-28 III.A2~~-4(T-05)~~ .TP-29 III.A3~~-4(T-05)~~ .TP-28 III.A3~~-4(T-05)~~ .TP-29 III.A4.TP-28 III.A5~~-4(T-05)~~ .TP-28 III.A5~~-4(T-05)~~ .TP-29 III.A6~~-1(T-18)~~ .TP-107 III.A7~~-3(T-05)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							.TP-28 III.A7~~-3(T-05)~~ .TP-29 III.A8~~-3(T-05)~~ ~~III.A8-3(T-05)~~ .TP-29 III.A9~~-3(T-05)~~ .TP-28 III.A9~~-3(T-05)~~ .TP-29
~~66~~	~~BWR/PWR~~68	~~Groups 1-5, 7, 9: concrete (accessible areas): interior and above-grade exterior~~BWR/PWR	~~Cracking; loss of bond; and loss of material (spalling, scaling)~~ ~~due to corrosion of embedded steel~~High-strength structural bolting	~~Chapter XI.S6, "Structures Monitoring"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.A1.TP-26~~ ~~III.A2.TP-26~~ ~~III.A3.TP-26~~ ~~III.A4.TP-26~~ ~~III.A5.TP-26~~ ~~III.A7.TP-26~~	III.~~A1-9(T-04)~~ ~~III.A2-9(T-04)~~ ~~III.A3-9(T-04)~~ ~~III.A4-3(T-04)~~

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~III.A9.TP-26~~ No	~~III.A5-9(T-04)~~ ~~III.A7-8(T-04)~~ ~~III.A9-8(T-04)~~ B1.1.TP-41
~~67~~M	~~BWR/PW~~R69	~~Groups 1-5, 7, 9: Concrete: interior; above-grade exterior, Groups 1-3, 5, 7-9 - concrete (inaccessible areas): below-grade exterior; foundation, Group 6: concrete (inaccessible areas): all~~BWR/PWR	~~Increase in porosity and permeability; cracking; loss of material (spalling, scaling)~~ ~~due to aggressive chemical attack~~High-strength structural bolting	~~Chapter XI.S6, "Structures Monitoring"~~Cracking due to stress corrosion cracking	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A1.TP-28~~ ~~III.A1.TP-29~~ ~~III.A2.TP-28~~ ~~III.A2.TP-29~~ ~~III.A3.TP-28~~ ~~III.A3.TP-29~~ ~~III.A4.TP-28~~ ~~III.A5.TP-28~~ ~~III.A5.TP-29~~ ~~III.A6.TP-107~~ ~~III.A7.TP-28~~	III.A1-~~10(T-06)~~ ~~III.A1-5(T-07)~~ .TP-300 III.A2-~~10(T-06)~~ ~~III.A2-5(T-07)~~ .TP-300 III.A3-~~10(T-06)~~ ~~III.A3-5(T-07)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~III.A7.TP-29~~ ~~III.A8.TP-29~~ ~~III.A9.TP-28~~ ~~III.A9.TP-29~~ No	III.A4.TP-300~~-4(T-06)~~ III.A5.TP-300~~-10(T-06)~~ ~~III.A5-5(T-07)~~ ~~III.A6-3(T-19)~~ III.A7.TP-300~~-9(T-06)~~ ~~III.A7-4(T-07)~~ III.A8.TP-300~~-4(T-07)~~ III.A9.TP-300~~-9(T-06)~~ ~~III.A9-4(T-07)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							.TP-300 III.B2.TP-300 III.B3.TP-300 III.B4.TP-300
~~68~~	~~BWR/PWR~~70	~~High-strength structural bolting~~BWR/PWR	~~Cracking due to stress corrosion cracking~~Masonry walls: all	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Cracking due to restraint shrinkage, creep, aggressive environment	~~No~~AMP XI.S5, "Masonry Walls"	~~III.B1.1.TP-41~~ No	~~III.B1.1-3(T-27)~~ III.A1.T-12 III.A2.T-12 III.A3.T-12 III.A5.T-12 III.A6.T-12
~~69~~M	~~BWR/PWR~~71	~~High-strength structural bolting~~BWR/PWR	~~Cracking due to stress corrosion cracking~~Masonry walls: all	~~Chapter XI.S6, "Structures Monitoring"~~ ~~Note: ASTM A 325, F 1852, and ASTM A 490 bolts used in civil structures have not~~	~~No~~AMP XI.S5, "Masonry Walls"	~~III.A1.TP-300~~ ~~III.A2.TP-300~~ ~~III.A3.TP-300~~ ~~III.A4.TP-300~~ ~~III.A5.TP-300~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				~~shown to be prone to SCC. SCC potential need not be evaluated for these bolts.~~Loss of material (spalling, scaling) and cracking due to freeze-thaw		~~III.A7.TP-300~~ ~~III.A8.TP-300~~ ~~III.A9.TP-300~~ ~~III.B2.TP-300~~ ~~III.B3.TP-300~~ ~~III.B4.TP-300~~ ~~III.B5.TP-300~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ III.A1.TP-34 III.A2.TP-34 III.A3.TP-34 III.A5.TP-34 III.A6.TP-34
~~70~~M	~~BWR/PWR~~72	~~Masonry walls: all~~BWR/PWR	~~Cracking due to restraint shrinkage, creep, and aggressive environment~~Seals; gasket; moisture barriers (caulking,	~~Chapter XI.S5, "Masonry Walls"~~Loss of sealing due to wear, damage, erosion, tear, surface cracks, other defects	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A1.T-12~~ ~~III.A2.T-12~~ ~~III.A3.T-12~~ ~~III.A5.T-12~~	~~III.A1-11(T-12)~~ ~~III.A2-11(T-12)~~ ~~III.A3-11(T-12)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			flashing, and other sealants)			~~III.A6.T-12~~ No	~~III.A5-11(T-12)~~ III.A6~~-10(T-12)~~.TP-7
~~71~~	~~BWR/PWR~~73	~~Masonry walls: all~~BWR/PWR	~~Loss of material (spalling, scaling) and cracking due to freeze-thaw~~Service Level I coatings	~~Chapter XI.S5, "Masonry Walls"~~Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	~~No~~AMP XI.S8, "Protective Coating Monitoring and Maintenance"	~~III.A5.TP-34~~ No	~~N/A~~ III.A4.TP-301
~~72~~M	~~BWR/PWR~~74	~~Seals; gasket; moisture barriers (caulking, flashing, and other sealants)~~BWR/PWR	~~Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)~~Sliding support bearings; sliding support surfaces	~~Chapter XI.S6, "Structures Monitoring"~~Loss of mechanical function due to corrosion, distortion, dirt or debris accumulation, overload, wear	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A6.TP-7~~ No	III.~~A6-12(~~B2.TP-~~7)~~46 III.B2.TP-47 III.B4.TP-46 III.B4.TP-47
~~73~~M	~~BWR/PWR~~75	~~Service Level I coatings~~BWR/PWR	~~Loss of coating integrity due to blistering, cracking, flaking,~~	~~Chapter XI.S8, "Protective Coating Monitoring and Maintenance"~~Loss of mechanical function	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.A4.TP-301~~ No	~~N/A~~ III.B1.1.TP-45 III.B1.2.TP-45

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			~~peeling, physical damage~~Sliding surfaces	due to corrosion, distortion, dirt or debris accumulation, overload, wear			III.B1.3.TP-45
~~74~~M	~~BWR/PWR~~76	~~Sliding support bearings; sliding support surfaces~~BWR/PWR	~~Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear~~Sliding surfaces: radial beam seats in BWR drywell	~~Chapter XI.S6, "Structures Monitoring"~~Loss of mechanical function due to corrosion, distortion, dirt or debris accumulation, overload, wear	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.B2.TP-46~~ ~~III.B2.TP-47~~ ~~III.B4.TP-46~~ ~~III.B4.TP-47~~ No	III.~~B2-2(~~A4.TP-~~1)~~ ~~III.B2-3(TP-2)~~ ~~III.B4-2(TP-1)~~ ~~III.B4-3(TP-2)~~ 35
~~75~~M	~~BWR/PWR~~77	~~Sliding surfaces~~BWR/PWR	~~Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear~~Steel components: all structural steel	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of material due to corrosion	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.B1.1.TP-45~~ ~~III.B1.2.TP-45~~ ~~III.B1.3.TP-45~~ No	~~III.B1.1-5(T-32)~~ ~~III.B1.2-3(T-32)~~ ~~III.B1.3-3(T-32)~~ III.A1.TP-302 III.A2.TP-302 III.A3.TP-302

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							III.A4.TP-302 III.A5.TP-302 III.A7.TP-302 III.A8.TP-302
~~76~~M	~~BWR/PWR~~78	~~Sliding surfaces: radial beam seats in BWR drywell~~BWR/PWR	~~Loss of mechanical function~~ ~~due to corrosion, distortion, dirt, overload, wear~~Stainless steel fuel pool liner	~~Chapter XI.S6, "Structures Monitoring"~~Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry," and monitoring of the spent fuel pool water level and leakage from the leak chase channels.	~~III.A4.TP-35~~ No	III.~~A4-6(~~A5.T-~~13)~~ 14
~~77~~	~~BWR/PWR~~79	~~Steel components: all structural steel~~BWR/PWR	~~Loss of material~~ ~~due to corrosion~~Steel components: piles	~~Chapter XI.S6, "Structures Monitoring"~~ ~~If protective coatings are relied upon to manage the effects of aging, the structures monitoring program is to include provisions to address protective coating monitoring and maintenance.~~Loss of	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A1.TP-302~~ ~~III.A2.TP-302~~ ~~III.A3.TP-302~~ ~~III.A4.TP-302~~ ~~III.A5.TP-302~~ ~~III.A7.TP-302~~ ~~III.A8.TP-302~~ No	~~III.A1-12(T-11)~~ ~~III.A2-12(T-11)~~ III.A3~~-12(T-11)~~ ~~III.A4-5(T-11)~~ ~~III.A5-12(T-11)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
				material due to corrosion			~~III.A7-10(T-11)~~ ~~III.A8-8(T-11)~~ .TP-219
~~78~~M	~~BWR/PWR~~80	~~Steel components: fuel pool liner~~BWR/PWR	~~Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion~~Structural bolting	~~Chapter XI.M2, "Water Chemistry," and Monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.~~Loss of material due to general, pitting, crevice corrosion	~~No, unless leakages have been detected through the SFP liner that cannot be accounted for from the leak chase channels~~AMP XI.S6, "Structures Monitoring"	~~III.A5.T-14~~ No	~~III.A5-13(T-14)~~ III.A1.TP-248 III.A2.TP-248 III.A3.TP-248 III.A4.TP-248 III.A5.TP-248 III.A6.TP-248 III.A7.TP-248 III.A8.TP-248 III.A9.TP-248 III.B2.TP-248 III.B3.TP-248

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							III.B4.TP-248
~~79~~	~~BWR/PWR~~81	~~Steel components: piles~~BWR/PWR	~~Loss of material due to corrosion~~Structural bolting	~~Chapter XI.S6, "Structures Monitoring"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.A3.TP-219~~ No	~~N/A~~ III.B1.1.TP-226 III.B1.2.TP-226 III.B1.3.TP-226
~~80~~M	~~BWR/PWR~~82	~~Structural bolting~~BWR/PWR	~~Loss of material due to general, pitting and crevice corrosion~~Structural bolting	~~Chapter XI.S6, "Structures Monitoring"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.A1.TP-248~~ ~~III.A2.TP-248~~ ~~III.A3.TP-248~~ ~~III.A4.TP-248~~ ~~III.A5.TP-248~~ ~~III.A6.TP-248~~ ~~III.A7.TP-248~~ ~~III.A8.TP-248~~ ~~III.A9.TP-248~~ ~~III.B2.TP-248~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~III.B3.TP-248~~ ~~III.B4.TP-248~~ ~~III.B5.TP-248~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ III.A1.TP-274 III.A2.TP-274 III.A3.TP-274 III.A4.TP-274 III.A5.TP-274 III.A7.TP-274 III.A8.TP-274 III.A9.TP-274 III.B2.TP-274 III.B3.TP-274 III.B4.TP-274
~~81~~M	~~BWR/PWR~~83	~~Structural bolting~~BWR/PWR	~~Loss of material~~	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of material	~~No~~AMP XI.S7, "Inspection of Water-Control	~~III.B1.1.TP-226~~ ~~III.B1.2.TP-226~~	~~N/A~~ ~~N/A~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			~~due to general, pitting, and crevice corrosion~~Structural bolting	due to general, pitting, crevice corrosion	Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	~~III.B1.3.TP-226~~ No	~~N/A~~ III.A6.TP-221
~~82~~D	~~BWR/PWR~~84	~~Structural bolting~~	~~Loss of material~~ ~~due to general, pitting, and crevice corrosion~~	~~Chapter XI.S6, "Structures Monitoring"~~	~~No~~	~~III.A1.TP-274~~ ~~III.A2.TP-274~~ ~~III.A3.TP-274~~ ~~III.A4.TP-274~~ ~~III.A5.TP-274~~ ~~III.A7.TP-274~~ ~~III.A8.TP-274~~ ~~III.A9.TP-274~~ ~~III.B2.TP-274~~ ~~III.B3.TP-274~~ ~~III.B4.TP-274~~	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
						~~III.B5.TP-274~~	~~N/A~~
~~83~~M	~~BWR/PWR~~85	~~Structural bolting~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Structural bolting	~~Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.A6.TP-221~~ No	~~N/A~~ III.B1.1.TP-232 III.B1.2.TP-232 III.B1.3.TP-232
~~84~~	~~BWR/PWR~~86	~~Structural bolting~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Structural bolting	~~Chapter XI.M2, "Water Chemistry," and Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.B1.3.TP-232~~ No	~~N/A~~ III.B1.1.TP-235 III.B1.2.TP-235 III.B1.3.TP-235
~~85~~	~~BWR/PWR~~87	~~Structural bolting~~BWR/PWR	~~Loss of material due to pitting and crevice~~	~~Chapter XI.M2, "Water Chemistry," for BWR water, and~~	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.B1.1.TP-232~~ ~~III.B1.2.TP-232~~ No	~~N/A~~ ~~N/A~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			~~corrosion~~Structural bolting	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of preload due to self-loosening			III.B1.1.TP-229 III.B1.2.TP-229 III.B1.3.TP-229
~~86~~M	~~BWR/PWR~~88	~~Structural bolting~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Structural bolting	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of preload due to self-loosening	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.B1.1.TP-235~~ ~~III.B1.2.TP-235~~ ~~III.B1.3.TP-235~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ III.A1.TP-261 III.A2.TP-261 III.A3.TP-261 III.A4.TP-261 III.A5.TP-261 III.A6.TP-261 III.A7.TP-261 III.A8.TP-261 III.A9.TP-261 III.B2.TP-

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							261 III.B3.TP-261 III.B4.TP-261
~~87~~M	~~BWR/PWR~~89	~~Structural bolting~~PWR	~~Loss of preload due to self-loosening~~Support members; welds; bolted connections; support anchorage to building structure	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of material due to boric acid corrosion	~~No~~AMP XI.M10, "Boric Acid Corrosion"	~~III.B1.1.TP-229~~ ~~III.B1.2.TP-229~~ ~~III.B1.3.TP-229~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ III.B1.1.T-25 III.B1.1.TP-3 III.B1.2.T-25 III.B1.3.TP-3 III.B1.2.TP-3 III.B2.T-25 III.B2.TP-3 III.B3.T-25 III.B3.TP-3 III.B4.T-25

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							III.B4.TP-3
~~88~~M	~~BWR/PWR~~90	~~Structural bolting~~BWR/PWR	~~Loss of preload due to self-loosening~~Support members; welds; bolted connections; support anchorage to building structure	~~Chapter XI.S6, "Structures Monitoring"~~Loss of material due to general (steel only), pitting, crevice corrosion	~~No~~AMP XI.M2, "Water Chemistry," and AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.A1.TP-261~~ ~~III.A2.TP-261~~ ~~III.A3.TP-261~~ ~~III.A4.TP-261~~ ~~III.A5.TP-261~~ ~~III.A6.TP-261~~ ~~III.A7.TP-261~~ ~~III.A8.TP-261~~ ~~III.A9.TP-261~~ ~~III.B2.TP-261~~ ~~III.B3.TP-261~~ ~~III.B4.TP-261~~ ~~III.B5.TP-261~~ No	~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ ~~N/A~~ III.B1.1.TP-10

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	**~~Type~~ID**	**~~Component~~Type**	**~~Aging Effect/Mechanism~~Component**	**Aging ~~Management Programs~~Effect/Mechanism**	**~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA**	**~~Rev2 Item~~Further Evaluation Recommended**	**~~Rev1~~GALL-SLR Item**
~~89~~	~~PWR~~91	~~Support members; welds; bolted connections; support anchorage to building structure~~BWR/PWR	~~Loss of material due to boric acid corrosion~~Support members; welds; bolted connections; support anchorage to building structure	~~Chapter XI.M10, "Boric Acid Corrosion"~~Loss of material due to general, pitting corrosion	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF"	~~III.B1.1.T-25~~ ~~III.B1.1.TP-3~~ ~~III.B1.2.T-25~~ ~~III.B1.3.TP-3~~ ~~III.B1-2.TP-3~~ ~~III.B2.T-25~~ ~~III.B2.TP-3~~ ~~III.B3.T-25~~ ~~III.B3.TP-3~~ ~~III.B4.T-25~~ ~~III.B4.TP-3~~ ~~III.B5.T-25~~ ~~III.B5.TP-3~~ No	III.B1.1~~-14(~~.T-~~25)~~ ~~III.B1.1-8(TP-3)~~ 24 III.B1.2~~-11(~~.T-~~25)~~ 24 III.B1.3~~-6(TP-3)~~ ~~III.B1.2-6(TP-3)~~ ~~III.B2-11(~~.T-~~25)~~ ~~III.B2-6(TP-3)~~ ~~III.B3-8(T-25)~~ ~~III.B3-4(TP-3)~~ ~~III.B4-11(T-25)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~III.B4-6(TP-3)~~ ~~III.B5-8(T-25)~~ ~~III.B5-4(TP-3)~~ 24
~~90~~M	~~BWR/PWR~~92	~~Support members; welds; bolted connections; support anchorage to building structure~~BWR/PWR	~~Loss of material due to general (steel only), pitting, and crevice corrosion~~Support members; welds; bolted connections; support anchorage to building structure	~~Chapter XI.M2, "Water Chemistry," for BWR water, and Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of material due to general, pitting corrosion	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.B1.1.TP-10~~ No	III.~~B1.1-11(~~B2.TP-~~10)~~ 43 III.B3.TP-43 III.B4.TP-43
~~91~~	~~BWR/PWR~~93	~~Support members; welds; bolted connections; support anchorage to building structure~~BWR/PWR	~~Loss of material due to general and pitting corrosion~~Support members; welds; bolted connections; support anchorage to building structure	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.S6, "Structures Monitoring"	~~III.B1.1.T-24~~ ~~III.B1.2.T-24~~ ~~III.B1.3.T-24~~ No	III.~~B1.1-13(T-24)~~ B2.TP-6 III.~~B1.2-10(T-24)~~ ~~III.B1.3-10(T-24)~~ B4.TP-6

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~92~~M	~~BWR/PWR~~94	~~Support members; welds; bolted connections; support anchorage to building structure~~BWR/PWR	~~Loss of material due to general and pitting corrosion~~Vibration isolation elements	~~Chapter XI.S6, "Structures Monitoring"~~Reduction or loss of isolation function due to radiation hardening, temperature, humidity, sustained vibratory loading	~~No~~AMP XI.S3, "ASME Section XI, Subsection IWF" and/or AMP XI.S6, "Structures Monitoring"	~~III.B2.TP-43~~ ~~III.B3.TP-43~~ ~~III.B4.TP-43~~ ~~III.B5.TP-43~~ No	III.~~B2-10(~~B1.1.T-~~30)~~33 III.~~B3-7(~~B1.2.T-~~30)~~33 III.B1.3.T-33 III.B4~~-10(T-30)~~ ~~III.B5-7(T-30)~~ .TP-44
~~93~~M	~~BWR/PWR~~95	~~Support members; welds; bolted connections; support anchorage to building structure~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Aluminum, galvanized steel and stainless steel support members; welds; bolted connections; support anchorage to building structure exposed to air – indoor uncontrolled	~~Chapter XI.S6, "Structures Monitoring"~~None	~~No~~None	~~III.B2.TP-6~~ ~~III.B4.TP-6~~ No	~~III.B2-7(TP-6)~~ ~~III.B4-7(TP-6)~~ III.B1.1.TP-4 III.B1.1.TP-8 III.B1.2.TP-4 III.B1.2.T

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							P-8 III.B1.3.TP-4 III.B1.3.TP-8 III.B2.TP-4 III.B2.TP-8 III.B3.TP-4 III.B3.TP-8 III.B4.TP-4 III.B4.TP-8
~~94~~N	~~BWR/PWR~~96	~~Vibration isolation elements~~BWR/PWR	~~Reduction or loss of isolation function due to radiation hardening, temperature, humidity, sustained vibratory loading~~Groups 6: concrete (accessible areas): all	~~Chapter XI.S3, "ASME Section XI, Subsection IWF"~~Cracking due to expansion from reaction with aggregates	~~No~~AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants"	~~III.B1.1.T-33~~ ~~III.B1.2.T-33~~ ~~III.B1.3.T-33~~ ~~III.B4.TP-44~~ No	III.~~B1.1-15(~~A6.T-~~33)~~ ~~III.B1.2-12(T-33)~~ ~~III.B1.3-11(T-33)~~ ~~III.B4-12(T-31)~~ 34

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~95~~N	~~BWR/PWR~~97	~~Aluminum, galvanized steel and stainless steel Support members; welds; bolted connections; support anchorage to building structure exposed to Air – indoor, uncontrolled~~BWR/PWR	~~None~~Group 4: Concrete (reactor cavity area proximate to the reactor vessel): reactor (primary/biological) shield wall; sacrificial shield wall; reactor vessel support/pedestal structure	~~None~~Reduction of strength; loss of mechanical properties due to irradiation (i.e., radiation interactions with material and radiation-induced heating)	~~NA - No AEM or AMP~~Plant-specific aging management program	~~III.B1.1.TP-4~~ ~~III.B1.1.TP-8~~ ~~III.B1~~Yes (SRP-SLR Section 3.5.2.~~TP-4~~ ~~III.B1.~~2.~~TP-8~~ ~~III.B1.3.TP-4~~ ~~III.B1-3.TP-8~~ ~~III.B2.TP-4~~ ~~III.B2.TP-8~~ ~~III.B3.TP-4~~ ~~III.B3.TP-8~~ ~~III.B4.TP-4~~ ~~III.B4.TP-8~~ ~~III.B5.TP-4~~ ~~III.B5.TP-8~~ 2.6)	III.~~B1.1-10(TP-4)~~ ~~III.B1.1-6(TP-8)~~ ~~III.B1.1-7(TP-11)~~ ~~III.B.1.1-9(TP-5)~~ ~~III.B1.2-8(TP-4)~~ ~~III.B1.2-4(TP-8)~~ ~~III.B1.2-5(TP-11)~~ ~~III.B1.2-7(TP- 5)~~ ~~III.B1.3-8(TP-4)~~ ~~III.B1.3-4(TP-8)~~ ~~III.B1.3-5(TP-11)~~ ~~III.B1.3-7(TP-5)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~ Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
							~~III.B2-9(TP-4)~~
							~~III.B2-4(TP-8)~~
							~~III.B2-8(TP-5) III.B2-5(TP-11)~~
							~~III.B3-6(TP-4)~~
							~~III.B3-2(TP-8)~~
							~~III.B3-5(TP-5) III.B3-3(TP-11)~~
							~~III.B4-9(TP-4)~~
							~~III.B4-4(TP-8)~~
							~~III.B4-8(TP-5) III.B4-5(TP-11)~~

Table 3.5-1. Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of the GALL~~-~~SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	**~~Type~~ID**	**~~Component~~Type**	**~~Aging Effect/Mechanism~~Component**	**Aging ~~Management Programs~~Effect/Mechanism**	**~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA**	**~~Rev2 Item~~Further Evaluation Recommended**	**~~Rev1~~GALL-SLR Item**
							~~III.B5-6(TP-4)~~ ~~III.B5-2(TP-8)~~ ~~III.B5-5(TP-5) III.B5-3(TP-11)~~ A4.T-35

Table 3.5-2 ~~Aging Management Programs.~~ AMPs and Additional Guidance Appendices Recommended for Containments, Structures, and Component Supports	
GALL-SLR Report Chapter/AMP	**Program Name**
Chapter XI.M2	Water Chemistry
Chapter XI.M10	Boric Acid Corrosion
Chapter XI.M18	Bolting Integrity
Chapter XI.S1	ASME Section XI, Subsection IWE ~~Inservice Inspection (IWE)~~
Chapter XI.S2	ASME Section XI, Subsection IWL ~~Inservice Inspection (IWL)~~
Chapter XI.S3	ASME Section XI, Subsection IWF ~~Inservice inspection (IWF)~~
Chapter XI.S4	10 CFR Part 50, Appendix J
Chapter XI.S5	Masonry Walls
Chapter XI.S6	Structures Monitoring
Chapter XI.S7	~~R.G. 1.127,~~ Inspection of Water-Control Structures Associated with Nuclear Power Plants
Chapter XI.S8	Protective Coating Monitoring and Maintenance
GALL-SLR Report Appendix ~~for GALL~~A	Quality Assurance for Aging Management Programs
GALL-SLR Report Appendix B	Operating Experience for Aging Management Programs
SRP-~~LR~~SLR Appendix A.1	~~Plant-specific AMP~~Aging Management Review—Generic (Branch Technical Position RLSB-1)

3.6 Aging Management of Electrical and Instrumentation and Controls

Review Responsibilities

Primary~~ - ~~—Branches assigned responsibility by Project Manager (PM) as described in this Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-~~LR~~SLR) Section 3.0~~ of this SRP-LR~~.

3.6.1 Areas of Review

This section addresses the aging management review (AMR) and the associated ~~AMP~~aging management programs (AMPs) of the electrical and instrumentation and ~~controls~~control (I&C). For a recent vintage plant, the information related to the electrical and I&C 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). For older plants, the location of applicable information is plant~~-~~-specific because an older plant’s FSAR may have predated NUREG~~-~~–0800. Typical electrical and I&C components that are subject to an AMR for subsequent license renewal (SLR) are electrical cables and connections, metal enclosed buses, cable bus, fuse holders, high-voltage insulators, transmission conductors and connections, and switchyard bus and connections.

The responsible review organization is to review the following ~~LRA~~subsequent license renewal application (SLRA) AMR and AMP items assigned to it, per SRP-~~LR~~SLR Section 3.0:

AMRs

- AMR results consistent with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
- AMR results for which further evaluation is recommended ~~by the GALL Report~~
- AMR results not consistent with or not addressed in the GALL-SLR Report

AMPs

- Consistent with GALL-SLR Report AMPs
- Plant-specific AMPs

FSAR Supplement

- The responsible review organization is to review the FSAR Supplement associated with each assigned AMP.

3.6.2 Acceptance Criteria

The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the ~~NRC’s~~U.S. Nuclear Regulatory Commissions (NRC) regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21.

3.6.2.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The AMRs and the AMPs applicable to the electrical and I&C components are described and evaluated in Chapter VI of ~~NUREG-1801, "~~the Generic Aging Lessons Learned (GALL-SLR) Report~~" (Ref. 2).~~.

The applicant's ~~LRA~~SLRA should provide sufficient information for the NRC reviewer to confirm that the specific ~~LRA~~SLRA AMR item and the associated ~~LRA~~SLRA AMP are consistent with the cited GALL-SLR Report AMR item. The ~~staff~~ reviewer should then confirm that the ~~LRA~~SLRA AMR item is consistent with the GALL-SLR Report AMR item to which it is compared.

When the applicant is crediting a different AMP than recommended in the GALL-SLR Report, the reviewer should confirm that the alternate AMP is valid to use for aging management and will be capable of managing the effects of aging as adequately as the AMP recommended by the GALL-SLR Report.

3.6.2.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic acceptance criteria defined in Section 3.6.2.1 need to be applied first for all of the AMRs and AMPs reviewed as part of this section. In addition, if the GALL-SLR Report AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations. Refer to Table 3.6-1, comparing the "Further Evaluation Recommended" and the "~~Rev2~~GALL-SLR Item" ~~columns~~column, for the AMR items that reference the following subsections. ~~The 2005 AMR item counterpart is provided in the "Rev1 Item" column.~~

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Environmental qualification 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, "Environmental Qualification (EQ) of Electrical Equipment," of this SRP-~~LR~~SLR.

~~1.1.7.6.1~~ 3.6.2.2.2 Reduced Insulation Resistance Due to ~~Presence of Any Salt Deposits and Surface Contamination, and~~ Loss of Material Due to ~~Mechanical Wear~~General, Pitting, and Crevice Corrosion, Loosening of Bolts Caused by ~~Wind Blowing on Transmission Conductors~~

~~Reduced insulation resistance due to presence~~*Thermal Cycling and Ohmic Heating, Degradation Caused Thermal/Thermoxidative Degradation of ~~any salt deposits~~Organics and ~~surface contamination~~Photolysis (UV Sensitive Materials Only) of Organics, Moisture/Debris Intrusion and Ohmic Heating*

Reduced insulation resistance due to loss of material due to general, pitting, and crevice corrosion, loosening of bolts caused by thermal cycling and ohmic heating, degradation caused thermal/thermoxidative degradation of organics and photolysis [ultraviolet (UV) sensitive materials only] of organics and moisture/debris intrusion could occur in ~~high-voltage~~

~~insulators.~~cable bus assemblies. The GALL-SLR Report recommends further evaluation of a plant-specific ~~AMP for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific~~Cable Bus AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position (BTP) RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

3.6.2.2.3 Loss of Material Due to Wind-Induced Abrasion, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of ~~Pre-load~~Preload

Loss of material due to wind-induced abrasion, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of ~~pre-load~~preload could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL-SLR Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in ~~Branch Technical Position~~BTP IQMB-1 (Appendix A.2 of this SRP-~~LR~~SLR).

3.6.2.~~3~~ ~~AMR~~2.5 Ongoing Review of Operating Experience

Acceptance criteria are described in Appendix A.4, “Operating Experience for AMPs.”

3.6.2.3 Aging Management Review Results Not Consistent With or Not Addressed in the ~~GALL~~ Generic Aging Lessons Learned for Subsequent License Renewal Report

Acceptance criteria are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

3.6.2.4 Aging Management Programs

For those AMPs that will be used for aging management and that are based on the program elements of an AMP in the GALL-SLR Report, the NRC reviewer performs an audit of AMPs credited in the ~~LRA~~SLRA to confirm consistency with the GALL-SLR AMPs identified in the GALL-SLR Report, Chapters X and XI.

If the applicant identifies an exception to any of the program elements of the cited GALL-SLR Report AMP, the ~~LRA~~SLRA AMP should include a basis demonstrating how the criteria of 10 CFR 54.21(a)(3) would still be met. The NRC reviewer should then confirm that the ~~LRA~~SLRA AMP, with all exceptions, would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the ~~LRA~~SLRA AMP, the reviewer identifies a difference between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP that should have been identified as an exception to the GALL-SLR Report AMP, the difference should be reviewed and properly dispositioned. The reviewer should document the disposition of all ~~LRA~~SLRA-defined exceptions and NRC staff-identified differences.

The ~~LRA~~SLRA should identify any enhancements that are needed to permit an existing AMP to be declared consistent with the GALL-SLR Report AMP to which the ~~LRA~~SLRA AMP is compared. The reviewer is to confirm both that the enhancement, when implemented, would allow the existing plant AMP to be consistent with the GALL-SLR Report AMP and also that the applicant has a commitment in the FSAR supplement to implement the enhancement prior to the subsequent period of extended operation. The reviewer should review and document the disposition of all enhancements.

If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

3.6.2.5 ~~FSAR~~Final Safety Analysis Review Supplement

The summary description of the programs and activities for managing the effects of aging for the subsequent period of extended operation in the FSAR supplement should be sufficiently comprehensive, such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects are managed during the subsequent period of extended operation. The description should also contain any future aging management activities, including commitments, license conditions, enhancements, and ~~commitments~~exceptions, to be ~~completed before entering~~implemented prior to or during the subsequent period of extended operation. Table 3.0-1 of this SRP-~~LR~~SLR provides examples of the type of information to be included in the FSAR Supplement. Table 3.6-2 lists the programs that are applicable for this SRP-~~LR~~SLR subsection.

3.6.3 Review Procedures

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

3.6.3.1 ~~AMR~~Aging Management Review Results Consistent With the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The applicant may reference the GALL-SLR Report in its ~~LRA~~SLRA, as appropriate, and demonstrate that the AMRs and AMPs at its facility are consistent with those reviewed and approved in the GALL-SLR Report. The reviewer should not conduct a re-review of the substance of the matters described in the GALL-SLR Report. If the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL-SLR Report, the reviewer should find acceptable the applicant's reference to the GALL-SLR Report in its ~~LRA.~~SLRA. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the ~~applicant has stated that the~~ applicable aging effects, ~~and that~~have been addressed based on the staff's review of industry and plant-specific operating experience ~~have been reviewed by the applicant and are evaluated in the GALL Report~~.

Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL-SLR Report. Performance of this review includes confirming that the applicant has identified those aging effects for the electrical and I&C components that are contained in the GALL-SLR Report as applicable to its plant.

3.6.3.2 ~~AMR~~Aging Management Review Results for Which Further Evaluation Is Recommended by the ~~GALL~~Generic Aging Lessons Learned for Subsequent License Renewal Report

The basic review procedures defined in Section 3.6.3.1 need to be applied first for all of the AMRs and AMPs provided in this section. In addition, if the GALL-SLR AMR item to which the ~~LRA~~SLRA AMR item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL-SLR Report for each of the following aging effect/aging mechanism combinations.

3.6.3.2.1 Electrical Equipment Subject to Environmental Qualification

Environmental qualification 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 NRC staff reviews the evaluation of this TLAA separately following the guidance in Section 4.4 of this SRP-~~LR~~SLR.

3.6.3.2.2 Reduced Insulation Resistance Due to ~~Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear Caused by Wind Blowing on Transmission Conductors~~Loss of Material Due to General, Pitting, and Crevice Corrosion, Loosening of Bolts Caused by Thermal Cycling and Ohmic Heating, Degradation Caused by Thermal/Thermoxidative Degradation of Organics and Photolysis (UV Sensitive Materials Only) of Organics, Moisture/Debris Intrusion and Ohmic Heating

The GALL SLR Report recommends a plant-specific Cable Bus AMP for the management of reduced insulation resistance due to ~~presence of any salt deposits and surface contamination for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution), and~~ loss of material due to ~~mechanical wear caused by wind blowing on transmission conductors in high-voltage insulators.~~general, pitting, and crevice corrosion, loosening of bolts caused by thermal cycling and ohmic heating, degradation caused thermal/thermoxidative degradation of organics and photolysis (UV sensitive materials only) of organics and moisture/debris intrusion. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.6.3.2.3 Loss of Material Due to Wind-Induced Abrasion, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of ~~Pre-load~~Preload

The GALL-SLR Report recommends a plant-specific AMP for the management of loss of material due to wind-induced abrasion, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of ~~pre-load~~preload in transmission conductors and connections, and in switchyard bus and connections. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.6.3.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's AMPs for ~~license renewal~~SLR should contain the elements of corrective actions, the 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, Appendix B does not apply to nonsafety-related components that are subject to an AMR for ~~license renewal.~~SLR. Nevertheless, the applicant has the option to expand the scope of its 10 CFR Part 50, Appendix B program to include these components and address these program elements. If the applicant chooses this option, the reviewer confirms that the applicant has documented such a commitment in the FSAR supplement. If the applicant chooses alternative means, the branch responsible for quality assurance (QA) should be requested to review the applicant's proposal on a case-by-case basis.

3.6.3.~~3~~ ~~AMR~~2.5 Ongoing Review of Operating Experience

The applicant's AMPs should contain the element of operating experience. The reviewer verifies that the applicant has appropriate programs or processes for the ongoing review of both plant-specific and industry operating experience concerning age-related degradation and aging management. Such reviews are used to ensure that the AMPs are effective to manage the aging effects for which they are created. The AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Additional information is in Appendix A.4, "Operating Experience for Aging Management Programs."

In addition, the reviewer confirms that the applicant has provided an appropriate summary description of these activities in the FSAR supplement. An example description is under "Operating Experience" in Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems."

3.6.3.3 Aging Management Review Results Not Consistent With or Not Addressed in the ~~GALL~~ Generic Aging Lessons Learned for Subsequent License Renewal Report

The reviewer should confirm that the applicant, in the ~~license renewal~~SLR application, has identified applicable aging effects, listed the appropriate combination of materials and environments, and has credited AMPs that will adequately manage the aging effects. The AMP credited by the applicant could be an AMP that is described and evaluated in the GALL-SLR Report or in a plant-specific program. Review procedures are described in ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

3.6.3.4 Aging Management Programs

The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL-SLR Report. If the applicant commits to an enhancement to make its ~~LRA~~SLRA AMP consistent with a GALL-SLR Report AMP, then the reviewer is to confirm that this enhancement, when implemented, will make the ~~LRA~~SLRA AMP consistent with the GALL-SLR Report AMP. If the applicant identifies, in the ~~LRA~~SLRA AMP, an exception to any of the program elements of the GALL-SLR Report AMP, the reviewer is to confirm that the ~~LRA~~SLRA AMP with the exception will satisfy the criteria of 10 CFR 54.21(a)(3). If the reviewer identifies a difference, not identified by the ~~LRA~~SLRA, between the ~~LRA~~SLRA AMP and the GALL-SLR Report AMP with which the ~~LRA~~SLRA claims to be consistent, the reviewer should confirm that the ~~LRA~~SLRA AMP with this difference satisfies 10 CFR 54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions, or differences. The AMPs evaluated in the GALL-SLR Report pertinent to the electrical and I&C components are summarized in Table 3.6-1 of this SRP-~~LR.~~SLR. The "~~Rev 2~~GALL-SLR Item" ~~(for 2010) and "Rev1 Item" (for 2005 counterpart) columns identify~~column identifies the AMR item numbers in the GALL-SLR Report, Chapters VI, presenting detailed information summarized by this row.

Table 3.6-1 of this SRP-~~LR~~SLR may identify a plant-specific AMP. If the applicant chooses to use a plant-specific program that is not a GALL-SLR AMP, the NRC reviewer should confirm that the plant-specific program satisfies the criteria of ~~Branch Technical Position~~BTP RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

3.6.3.5 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer confirms that the applicant has provided in its FSAR supplement information equivalent to that in Table 3.0-1 for aging management of the Electrical and I&C System. Table 3.6-2 lists the AMPs that are applicable for this SRP-~~LR~~SLR subsection. The reviewer also confirms that the applicant has provided information for Subsection 3.6.3.3, "AMR Results Not Consistent With or Not Addressed in the GALL-SLR Report," equivalent to that in Table 3.0-1.

~~The staff expects to impose a license condition on any renewed license to require~~ The applicant ~~to update~~updates its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). ~~As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.~~

As noted in Table 3.0-1, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should confirm that the applicant has identified and committed in the ~~license renewal application~~SLRA to any future aging management activities, including enhancements, exception, and commitments to be completed ~~before~~prior to or during the subsequent period of extended operation.

~~The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.~~

3.6.4 Evaluation Findings

If the reviewer determines that the applicant has provided information sufficient to satisfy the provisions of this section, then an evaluation finding similar to the following text should be included in the NRC staff's safety evaluation report:

On the basis of its review~~, as discussed above,~~ the NRC staff concludes that the applicant has demonstrated that the aging effects associated with the electrical and ~~instrumentation and controls~~I&C components will be adequately managed so that the intended functions will be maintained consistent with the ~~CLB~~current licensing basis for the subsequent period of extended operation, as required by 10 CFR 54.21(a)(3).

The NRC staff also reviewed the applicable FSAR Supplement program ~~summaries~~summary descriptions and concludes that they adequately describe the AMPs credited for managing aging of electrical and ~~instrumentation and controls~~I&C, as required by 10 CFR 54.21(d).

3.6.5 Implementation

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

3.6.6 References

1. NRC. NUREG~~-~~–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants~~, LWR Edition"~~." Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March 2007.

2. ~~NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

3. ~~NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Nuclear Energy Institute, Revision 6.~~

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~1~~M	~~BWR/PWR~~1	~~Electrical equipment subject to 10 CFR 50.49 EQ requirements composed of Various polymeric and metallic materials exposed to Adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage~~BWR/PWR	~~Various aging effects due to various mechanisms in accordance with 10 CFR 50.49~~Electrical equipment subject to 10 CFR 50.49 EQ requirements composed of various polymeric and metallic materials in plant areas subject to a harsh environment (i.e., loss of coolant accident (LOCA), high energy line break (HELB), or post LOCA environment or; An adverse localized environment for the most limiting qualified condition for temperature, radiation, or moisture for the component material (e.g., cable or connection insulation).	~~EQ is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii).~~ ~~See Chapter X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).~~Various aging effects due to various mechanisms in accordance with 10 CFR 50.49	~~Yes, TLAA (See subsection 3.6.2.2.1)~~EQ is a time-limited aging analysis (TLAA) to be evaluated for the subsequent period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See AMP X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for	~~VI.B.L-05~~ Yes, TLAA (See subsection 3.6.2.2.1)	VI.B~~-1(~~.L-05~~)~~

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
					meeting the requirements of 10 CFR 54.21(c)(1)(i)-(iii). See Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment and AMP X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for meeting the requirements of 10CFR 54.21(c)(1)(iii).		
~~2~~M	~~BWR/PWR~~2	~~High-voltage insulators composed of Porcelain; malleable iron; aluminum; galvanized steel; cement exposed to Air –~~	~~Loss of material due to mechanical wear caused by wind blowing on transmission conductors~~High-voltage electrical insulators composed of porcelain; malleable iron;	~~A plant-specific aging management program is to be evaluated~~Loss of material due to mechanical wear caused by movement of transmission conductors due to significant wind	~~Yes,~~AMP XI.E7, "High Voltage Insulators" A plant-specific ~~(See subsection 3.6.2.2.2)~~aging management program is to be evaluated	~~VI.A.LP-32~~ No	VI.A~~-10(~~.LP-~~11)~~ 32

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~outdoor~~BWR/PWR	aluminum; galvanized steel; cement exposed to air – outdoor				
~~3~~M	~~BWR/PWR~~3	~~High-voltage insulators composed of Porcelain; malleable iron; aluminum; galvanized steel; cement exposed to Air – outdoor~~BWR/PWR	~~Reduced insulation resistance due to presence of salt deposits or surface contamination~~High-voltage insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air – outdoor	~~A plant-specific aging management program is~~Reduced electrical insulation resistance due to ~~be evaluated for plants located such that the potential exists for salt~~ presence of salt deposits or surface contamination ~~(e.g., in the vicinity of salt water bodies or industrial pollution)~~	~~Yes, plant-specific (See subsection 3.6.2.2.2)~~AMP XI.E7, "High Voltage Insulators"	~~VI.A.LP-28~~ No)	VI.A~~-9(~~.LP-~~07)~~ 28
4	~~BWR/PWR~~4	~~Transmission conductors composed of Aluminum; steel exposed to Air – outdoor~~BWR/PWR	~~Loss of conductor strength due to corrosion~~Transmission conductors composed of aluminum; steel exposed to air – outdoor	~~A plant-specific aging management program is to be evaluated for ACSR~~Loss of conductor strength due to corrosion	~~Yes,~~A plant-specific ~~(See subsection 3.6.2.2.3)~~aging management program is to be evaluated for ACSR	~~VI.A.LP-38~~ Yes, plant-specific (See subsection 3.6.2.2.3)	VI.A~~-16(~~.LP-~~08)~~ 38
~~5~~M	~~BWR/PWR~~5	~~Transmission connectors composed of Aluminum; steel exposed to Air –~~	~~Increased resistance of connection due to oxidation or loss of pre-load~~Transmission connectors composed of	~~A plant-specific aging management program is to be evaluated~~Increased electrical resistance of connection due to	~~Yes,~~A plant-specific ~~(See subsection 3.6.2.2.3)~~aging management	~~VI.A.LP-48~~ Yes, plant-specific (See	VI.A~~-16(~~.LP-~~08)~~ 48

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~outdoor~~BWR/PWR	aluminum; steel exposed to air – outdoor	oxidation or loss of pre-load	program is to be evaluated	subsection 3.6.2.2.3)	
~~6~~M	~~BWR/PWR~~6	~~Switchyard bus and connections composed of Aluminum; copper; bronze; stainless steel; galvanized steel exposed to Air – outdoor~~BWR/PWR	~~Loss of material due to wind-induced abrasion; Increased resistance of connection due to oxidation or loss of pre-load~~Switchyard bus and connections composed of Aluminum; copper; bronze; stainless steel; galvanized steel exposed to air – outdoor	~~A plant-specific aging management program is to be evaluated~~Loss of material due to wind-induced abrasion; Increased electrical resistance of connection due to oxidation or loss of pre-load	~~Yes,~~A plant-specific ~~(See subsection 3.6.2.2.3)~~aging management program is to be evaluated	~~VI.A.LP-39~~ Yes, plant-specific (See subsection 3.6.2.2.3)	VI.A~~-15(~~.LP-~~09)~~ 39
~~7~~	~~BWR/PWR~~7	~~Transmission conductors composed of Aluminum; Steel exposed to Air – outdoor~~BWR/PWR	~~Loss of material due to wind-induced abrasion~~Transmission conductors composed of aluminum; steel exposed to air – outdoor	~~A plant-specific aging management program is to be evaluated for ACAR and ACSR~~Loss of material due to wind-induced abrasion	~~Yes,~~A plant-specific ~~(See subsection 3.6.2.2.3)~~aging management program is to be evaluated for ACAR and ACSR	~~VI.A.LP-47~~ Yes, plant-specific (See subsection 3.6.2.2.3)	VI.A~~-16(~~.LP-~~08)~~ 47
~~8~~M	~~BWR/PWR~~8	~~Insulation material for electrical cables and connections~~	~~Reduced insulation resistance~~	~~Chapter XI.E1, "Insulation Material for Electrical Cables and Connections Not~~	~~No~~AMP XI.E1, "Electrical Insulation for Electrical Cables	~~VI.A.LP-33~~ No	VI.A~~-2(L-01)~~ .LP-33

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~(including terminal blocks, fuse holders, etc.) composed of Various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to Adverse localized environment caused by heat, radiation, or moisture~~BWR/PWR	~~due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics;~~ ~~radiation-induced oxidation;~~ ~~moisture intrusion~~Electrical insulation for electrical cables and connections (including terminal blocks, etc.) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by heat, radiation, or moisture	~~Subject to 10 CFR 50.49 Environmental Qualification Requirements"~~Reduced electrical insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"		
~~9~~M	~~BWR/PWR~~9	~~Insulation material for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in~~	~~Reduced insulation resistance~~ ~~due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis~~	~~Chapter XI.E2, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification~~	~~No~~AMP XI.E2, "Electrical Insulation for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental	~~VI.A.LP-34~~ No	VI.A~~-3(L-02)~~ .LP-34

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~conductor insulation resistance (IR) composed of Various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to Adverse localized environment caused by heat, radiation, or moisture~~BWR/PWR	~~(UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion~~Electrical insulation for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by heat, radiation, or moisture	~~Requirements Used in Instrumentation Circuits"~~Reduced electrical insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Qualification Requirements Used in Instrumentation Circuits"		
~~10~~M	~~BWR/PWR~~10	~~Conductor insulation for inaccessible power cables greater than or equal to 400 volts (e.g., installed in conduit or direct buried) composed of Various organic~~	~~Reduced insulation resistance due to moisture~~Electrical conductor insulation for inaccessible power, instrumentation, and control cables (e.g., installed in conduit or direct buried) composed	~~Chapter XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"~~Reduced electrical insulation resistance due to moisture	~~No~~AMPs XI.E3A, XI.E3B, and XI.E3C, "Inaccessible Power, Instrumentation, and Control Cables Not Subject to 10 CFR 50.49	~~VI.A.LP-35~~ No	VI.A~~-4(L-03)~~ .LP-35

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~polymers (e.g., EPR, SR, EPDM, XLPE) exposed to Adverse localized environment caused by significant moisture~~BWR/PWR	of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to an adverse localized environment caused by significant moisture		Environmental Qualification Requirements"		
~~11~~	~~BWR/PWR~~11	~~Metal enclosed bus: enclosure assemblies composed of Elastomers exposed to Air – indoor, controlled or uncontrolled or Air – outdoor~~BWR/PWR	~~Surface cracking, crazing, scuffing, dimensional change (e.g. “ballooning” and “necking”), shrinkage, discoloration, hardening and loss of strength due to elastomer degradation~~Metal enclosed bus: enclosure assemblies composed of elastomers exposed to air – indoor controlled or uncontrolled, air – outdoor	~~Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"~~Surface cracking, crazing, scuffing, dimensional change (e.g. "ballooning" and "necking"), shrinkage, discoloration, hardening and loss of strength due to elastomer degradation	~~No~~AMP XI.E4, "Metal Enclosed Bus," or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	~~VI.A.LP-29~~ No	VI.A~~-12(~~.LP-~~10)~~ 29
~~12~~M	~~BWR/PWR~~12	~~Metal enclosed bus: bus/connections composed of~~	~~Increased resistance of connection~~	~~Chapter XI.E4, "Metal Enclosed Bus"~~Increased electrical resistance of	~~No~~AMP XI.E4, "Metal Enclosed Bus"	~~VI.A.LP-25~~ No	VI.A~~-11(~~.LP-~~04)~~ 25

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~Various metals used for electrical bus and connections exposed to Air – indoor, controlled or uncontrolled or Air – outdoor~~BWR/PWR	~~due to the loosening of bolts caused by thermal cycling and ohmic heating~~Metal enclosed bus: bus/connections composed of various metals used for electrical bus and connections exposed to air – indoor controlled or uncontrolled, air – outdoor	connection due to the loosening of bolts caused by thermal cycling and ohmic heating			
~~13~~M	~~BWR/PWR~~13	~~Metal enclosed bus: insulation; insulators composed of Porcelain; xenoy; thermo-plastic organic polymers exposed to Air – indoor, controlled or uncontrolled or Air – outdoor~~BWR/PWR	~~Reduced insulation resistance due to thermal/thermoxidative degradation of organics/thermoplastics, radiation-induced oxidation, moisture/debris intrusion, and ohmic heating~~Metal enclosed bus: electrical insulation; insulators composed of porcelain; xenoy; thermo-plastic organic polymers exposed to air – indoor controlled or	~~Chapter XI.E4, "Metal Enclosed Bus"~~Reduced electrical insulation resistance due to thermal/thermoxidative degradation of organics/thermoplastics , radiation-induced oxidation, moisture/debris intrusion, and ohmic heating	~~No~~AMP XI.E4, "Metal Enclosed Bus"	~~VI.A.LP-26~~ No	VI.A~~-14(~~.LP-~~05)~~ 26

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			uncontrolled, air – outdoor				
~~14~~	~~BWR/PWR~~14	~~Metal enclosed bus: external surface of enclosure assemblies composed of Steel exposed to Air – indoor, uncontrolled or Air – outdoor~~BWR/PWR	~~Loss of material due to general, pitting, and crevice corrosion~~Metal enclosed bus: external surface of enclosure assemblies composed of steel exposed to air – indoor uncontrolled, air – outdoor	~~Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring"~~Loss of material due to general, pitting, crevice corrosion	~~No~~AMP XI.E4, "Metal Enclosed Bus," or AMP XI.S6, "Structures Monitoring"	~~VI.A.LP-43~~ No	VI.A~~-13(~~.LP-~~06)~~ 43
~~15~~	~~BWR/PWR~~15	~~Metal enclosed bus: external surface of enclosure assemblies composed of Galvanized steel; aluminum exposed to Air – outdoor~~BWR/PWR	~~Loss of material due to pitting and crevice corrosion~~Metal enclosed bus: external surface of enclosure assemblies composed of galvanized steel; aluminum exposed to air – outdoor	~~Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring"~~Loss of material due to pitting, crevice corrosion	~~No~~AMP XI.E4, "Metal Enclosed Bus," or AMP XI.S6, "Structures Monitoring"	~~VI.A.LP-42~~ No	VI.A~~-13(~~.LP-~~06)~~ 42
~~16~~M	~~BWR/PWR~~16	~~Fuse holders (not part of active equipment): metallic clamps~~	~~Increased resistance of connection~~	~~Chapter XI.E5, "Fuse Holders"~~Increased electrical resistance of connection due to	~~No~~AMP XI.E5, "Fuse Holders" No aging	~~VI.A.LP-23~~ No	VI.A~~-8(~~.LP-~~01)~~ 23

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
		~~composed of Various metals used for electrical connections exposed to Air – indoor, uncontrolled~~BWR/PWR	~~due to chemical contamination, corrosion, and oxidation (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply);~~ ~~fatigue~~ ~~due to ohmic heating, thermal cycling, electrical transients~~Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor uncontrolled	chemical contamination, corrosion, and oxidation. (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply);	management program is required for those applicants who can demonstrate these fuse holders are located in an environment that does not subject them to environmental aging mechanisms and effects due to chemical contamination, corrosion, and oxidation.		
N	17	BWR/PWR	Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air-indoor controlled or uncontrolled	Increased electrical resistance of connection due to fatigue from ohmic heating, thermal cycling, electrical transients	AMP XI.E5, Fuse Holders" No aging management program is required for those applicants who	No	VI.A.L-07

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
					can demonstrate these fuse holders are not subject to fatigue due to ohmic heating, thermal cycling, electrical transients		
~~17~~M	~~BWR/PWR~~18	~~Fuse holders (not part of active equipment): metallic clamps composed of Various metals used for electrical connections exposed to Air – indoor, controlled or uncontrolled~~BWR/PWR	~~Increased resistance of connection~~ ~~due to fatigue caused by frequent manipulation or vibration~~Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor controlled or uncontrolled	~~Chapter XI.E5, "Fuse Holders"~~ ~~No aging management program is required for those applicants who can demonstrate these fuse holders are located in an environment that does not subject them~~Increased electrical resistance of connection due to ~~environmental aging mechanisms or~~ fatigue caused by frequent fuse removal/manipulation or vibration	~~No~~AMP XI.E5, "Fuse Holders" No aging management program is required for those applicants who can demonstrate these fuse holders are not subject to fatigue caused by frequent fuse removal/manipulation or vibration	~~VI.A.LP-31~~ No	VI.A~~-8(~~.LP-~~01)~~ 31

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~18~~M	~~BWR/PWR~~19	~~Cable connections (metallic parts) composed of Various metals used for electrical contacts exposed to Air – indoor, controlled or uncontrolled or Air – outdoor~~BWR/PWR	~~Increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation~~Cable connections (metallic parts) composed of various metals used for electrical contacts exposed to air – indoor controlled or uncontrolled, air – outdoor	~~Chapter XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"~~Increased electrical resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	~~No~~AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	~~VI.A.LP-30~~ No	VI.A~~-1(~~.LP-~~12)~~ 30
~~19~~M	~~PWR~~20	~~Connector contacts for electrical connectors exposed to borated water leakage composed of Various metals used for electrical contacts exposed to Air with borated water leakage~~PWR	~~Increased resistance of connection due to corrosion of~~Electrical connector ~~contact surfaces caused by intrusion of~~contacts for electrical connectors composed of various metals used for electrical contacts exposed to air with borated water leakage	~~Chapter XI.M10, "Boric Acid Corrosion"~~Increased electrical resistance of connection due to corrosion of connector contact surfaces caused by intrusion of borated water	~~No~~AMP XI.M10, "Boric Acid Corrosion"	~~VI.A.LP-36~~ No	VI.A~~-5(L-04)~~ .LP-36

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
~~20~~M	~~BWR/PWR~~21	~~Transmission conductors composed of Aluminum exposed to Air – outdoor~~BWR/PWR	~~Loss of conductor strength due to corrosion~~Transmission conductors composed of aluminum exposed to air – outdoor	~~None - for Aluminum Conductor Aluminum Alloy Reinforced (ACAR)~~Loss of conductor strength due to corrosion	~~None~~None - for Aluminum Conductor Aluminum Alloy Reinforced (ACAR) and All Aluminum Conductor (AAC)	~~VI.A.LP-46~~ None	VI.A~~-16(~~.LP-~~08)~~ 46
~~21~~M	~~BWR/PWR~~22	~~Fuse holders (not part of active equipment): insulation material, Metal enclosed bus: external surface of enclosure assemblies composed of Insulation material: bakelite; phenolic melamine or ceramic; molded polycarbonate; other, Galvanized steel; aluminum, Steel exposed to Air – indoor, controlled or uncontrolled~~BWR/PWR	~~None~~Fuse holders (not part of active equipment): insulation material composed of electrical insulation material: bakelite; phenolic melamine or ceramic; molded polycarbonate, and other, exposed to air – indoor controlled or uncontrolled	~~None~~Reduced electrical insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	~~NA - No AEM or AMP~~AMP XI.E5, "Fuse Holders" No aging management program is required for those applicants who can demonstrate these fuse holders are located in an environment that does not subject them to environmental aging mechanisms	~~VI.A.LP-24~~ ~~VI.A.LP-41~~ ~~VI.A.LP-44~~ No	VI.A~~-7(~~.LP-~~02)~~ ~~VI.A-13(LP-06)~~ ~~VI.A-13(LP-06)~~ 24

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	23	BWR/PWR	Metal enclosed bus: external surface of enclosure assemblies. Galvanized steel; aluminum. air – indoor controlled or uncontrolled	None	None	No	VI.A.LP-41
N	24	BWR/PWR	Metal enclosed bus: external surface of enclosure assemblies. Steel air – indoor controlled	None	None	No	VI.A.LP-44
N	26	BWR/PWR	Cable bus: enclosure assemblies composed of elastomers exposed to air – indoor controlled or uncontrolled, air – outdoor	Surface cracking, crazing, scuffing, dimensional change (e.g. "ballooning" and "necking"), shrinkage, discoloration, hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated	Yes, plant-specific (See subsection 3.6.2.2.2)	VI.A.L-08
N	27	BWR/PWR	Cable bus: external surface of enclosure assemblies galvanized steel; aluminum; air – indoor controlled or uncontrolled	None	None	No	VI.A.L-09
N	28	BWR/PWR	Cable bus: bus/connections composed of various metals used for electrical	Increased electrical resistance of connection due to the loosening of bolts	A plant-specific aging management	Yes, plant-specific (See	VI.A.L-10

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report							
~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
			bus connections exposed to air – indoor controlled or uncontrolled, air – outdoor	caused by thermal cycling and ohmic heating	program is to be evaluated	subsection 3.6.2.2.2)	
N	29	BWR/PWR	Cable bus: electrical insulation; insulators – exposed to air – indoor controlled or uncontrolled, air – outdoor	Reduced electrical insulation resistance due to degradation caused thermal/thermoxidative degradation of organics and photolysis (UV sensitive materials only) of organics, moisture/debris intrusion and ohmic heating	A plant-specific aging management program is to be evaluated	Yes, plant-specific (See subsection 3.6.2.2.2)	VI.A.L-11
N	30	BWR/PWR	Cable bus: external surface of enclosure assemblies composed of steel exposed to air – indoor uncontrolled or air – outdoor	Loss of material due to general, pitting, crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific (See subsection 3.6.2.2.2)	VI.A.L-12
N	31	BWR/PWR	Cable bus external surface of enclosure assemblies composed of galvanized steel; aluminum exposed to air – outdoor	Loss of material due to general, pitting, crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific (See subsection 3.6.2.2.2)	VI.A.L-13

Table 3.6-1. Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL-SLR Report

~~ID~~New (N), Modified (M), Deleted (D) Item	~~Type~~ID	~~Component~~Type	~~Aging Effect/Mechanism~~Component	Aging ~~Management Programs~~Effect/Mechanism	~~Further Evaluation Recommended~~Aging Management Program (AMP)/TLAA	~~Rev2 Item~~Further Evaluation Recommended	~~Rev1~~GALL-SLR Item
N	32	BWR/PWR	Cable bus: external surface of enclosure assemblies: composed of steel; air – indoor controlled	None	None	No	VI.A.L-14

Table 3.6-2 ~~Aging Management Programs.~~ AMPs and Additional Guidance Appendices Recommended for Electrical and Instrumentation and Control Systems	
GALL-SLR Report Chapter/AMP	**Program Name**
~~Chapter~~AMP X.E1	Environmental Qualification ~~(EQ)~~ of Electric Components ~~(TLAA)~~
~~Chapter~~AMP XI.E1	Electrical Insulation ~~Material~~ for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
~~Chapter~~AMP XI.E2	Electrical Insulation ~~Material~~ for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits
~~Chapter~~AMP XI.~~E3~~E3A	Electrical Insulation for Inaccessible Medium Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
AMP XI.E3B	Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
AMP XI.E3C	Electrical Insulation for Inaccessible Low Voltage Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
~~Chapter~~AMP XI.E4	Metal Enclosed Bus
~~Chapter~~AMP XI.E5	Fuse Holders
~~Chapter~~AMP XI.E6	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
AMP XI.E7	High Voltage Insulators
~~Chapter~~AMP XI.M10	Boric Acid Corrosion
~~Chapter~~AMP XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
~~Chapter~~AMP XI.S6	Structures Monitoring
GALL-SLR Report Appendix ~~for GALL~~A	Quality Assurance for Aging Management Programs
GALL-SLR Report Appendix B	Operating Experience for Aging Management Programs
SRP-~~LR~~SLR Appendix A.1	~~Plant-specific AMP~~Aging Management Review—Generic (Branch Technical Position RLBS-1)

~~CHAPTER~~ 4 TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses and Exemptions

Review Responsibilities

Primary~~ -~~ —Branch responsible for the time-limited aging analysis (TLAA) issues

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~~)~~. The technical review of TLAAs is addressed in Sections 4.2 through 4.7. As explained in more detail below, the list of TLAAs are certain plant-specific safety analyses that are ~~based on an explicitly assumed 40-year plant life (for example, aspects of the reactor vessel design).~~defined, in part, by the current operating term. Pursuant to Title 10 of the *Code of Federal Regulations* (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.

TLAAs may have developed since issuance of a plant's operating license. As indicated in 10 CFR 54.30, the adequacy of the plant's current licensing basis (CLB~~,~~), which includes TLAAs, is not an area within the scope of the license renewal review. Any questions regarding the adequacy of the CLB are 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 granted under 10 CFR 50.12 that are based on TLAAs. ~~However, the initial license renewal applicants have found no such exemptions for their plants. It is an applicant's option to include more analyses than those required by 10 CFR 54.21(c)(1).~~ The U.S. Nuclear Regulatory Commission (NRC) staff should focus its review to confirm that the applicant did not omit any TLAAs, as defined in 10 CFR 54.3.

Pursuant to 10 CFR 54.21(d), each application includes ~~an~~ a final safety analysis report (FSAR), updated final safety analysis report (UFSAR), or updated safety analysis report (USAR), as appropriate for the CLB supplement summary description for each TLAA that is identified in accordance with 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 delineate acceptable methods for meeting the requirements of the NRC's regulations in 10 CFR 54.21(c)(1). For the applicant's list of exemptions to be acceptable~~, the~~ under the requirement in 10 CFR 54.21(c)(2), the NRC staff should have reasonable assurance that there has been no omission of TLAAs from ~~that list~~the subsequent license renewal application (SLRA) that were used as the basis for receiving NRC approval of regulatory exemptions granted in accordance with 10 CFR 50.12 requirements.

~~Pursuant to 10 CFR 54.3,~~ TLAAs are those licensee calculations and analyses that~~:~~ meet all six of the following criteria, as defined in 10 CFR 54.3(a):

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, or component to perform its intended function(s), as delineated in 10 CFR 54.4(b); and

6. Are contained or incorporated by reference in the CLB.

The TLAA identification criterion in Criterion 1 is based only on a comparison to the scoping requirements in 10 CFR 54.4 and therefore does not limit the applicability of TLAAs only to those components that would be required to be screened in for an AMP in accordance with the requirement in 10 CFR 54.21(a)(1). Thus, the possibility exists that, for a given CLB, a TLAA may need to be identified for a given active component if the analysis in the CLB is determined to be in conformance with all six of the criteria in 10 CFR 54.3(a) for identifying an analysis as a TLAA. Fatigue flaw growth analyses of pressurized water reactor (PWR) reactor coolant pump flywheels are examples of plant-specific analyses that apply to an active component type and may need to be identified as a TLAA for a given application.

The applicant's FSAR (as updated) identifies TLAAs that were incorporated by reference into the CLB. In addition, for subsequent license renewal (SLR) applications, there may be situations where an analysis of record was not required to be identified as a TLAA for the current operating period (as approved in the renewed operating license for the facility), but will need to be identified as a TLAA for a proposed subsequent period of extended operation, as required by the regulation in 10 CFR 54.21(c)(1). Specifically, criterion 3 for TLAAs in 10 CFR 54.3(a) establishes that to be a TLAA the analysis has to involve time-limited assumptions defined by the current operating term. In *Federal Register Notice* (FRN) No. 95-11136, Volume 60, Number 88, dated May 8, 1995 (Ref. 3), the NRC identified that TLAAs are those:

> analyses with (i) time-related assumptions, (ii) utilized in determining the acceptability of SSCs, within the scope of license renewal (as defined in 10 CFR 54.4), (iii) which are based upon a period of plant operation equal to or greater than the current license term, but less than the cumulative period of plant operation (viz., the existing license term plus the period of extended operation requested in the renewed application).

For example, for an existing analysis that is part of the CLB and is based on a 60-year time assumption, the analysis would not necessarily have to be identified as a TLAA for the initial license renewal request because it would not conform to the definition of a TLAA, as clarified in FRN No. 95-11136; however, if the same analysis was left unchanged in the CLB and was going to be relied upon for a proposed SLR period, the analysis would conform to the third criterion for TLAAs in 10 CFR 54.3(a) because the 60-year assumed life would form the updated current operating term basis for the proposed SLR period.

The reviewer reviews the FSAR supplement for each TLAA identified as being within the scope of the ~~LRA~~SLRA, as defined in 10 CFR 54.3.

4.1.3 Review Procedures

For each area of review described in Subsection 4.1.1, the reviewer adheres to the following review procedures:

The reviewer uses the plant ~~UFSAR~~FSAR (as updated) and other CLB documents, such as NRC staff safety evaluation report (SERs~~,~~), to perform the review. The reviewer selects analyses that the applicant did not identify as TLAAs that are likely to meet the six criteria identified in Subsection 4.1.2. The reviewer verifies that the selected analyses, not identified by the applicant as TLAAs, do not meet at least one of the following criteria~~ (Ref. 1).~~:

Sections 4.2 through 4.6 identify typical types of TLAAs for most plants. Information on the applicant's methodology for identifying TLAAs also may be useful in identifying calculations that did not meet the six criteria below.

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a). Chapter 2 of this SRP~~-LR~~-SLR provides the reviewer guidance on the scoping and screening methodology, and on 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, change in dimension, change in material properties, loss of toughness, loss of prestress, settlement, cracking, and loss of dielectric properties.

3. Involve time-limited assumptions defined by the current operating term (e.g., 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 is supported by calculations or other analyses that explicitly include a time limit.

4. Were determined to be relevant by the licensee in making a safety determination. Relevancy is a determination that the applicant makes based on a review of the information available. A calculation or analysis is relevant if it can be shown to have a 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 applicant might have reached a different safety conclusion.

5. Show capability of the system, structure, or component to perform its intended function(s), as delineated. Involve conclusions or provide the basis for conclusions related to 10 CFR 54.4(b). Analyses that do not affect the intended functions of systems, structures, ~~or~~and components (SSCs) are not TLAAs.

6. Are contained or incorporated by reference in the CLB. The CLB includes the technical specifications as well as design basis information (as defined in 10 CFR 50.2), or licensee commitments documented in the plant-specific documents contained or incorporated by reference in the CLB, including but not limited to the FSAR, NRC SERs, the fire protection plan/hazards analyses, correspondence to and from the NRC, the quality assurance (QA) plan, and topical reports included as references to the FSAR. Calculations and analyses that are not contained in the CLB or not incorporated by

reference in the CLB are not TLAAs. If a code of record is in the FSAR for particular groups of structures or components, reference material includes all calculations called for by that code of record for those structures and components~~.~~ (SCs).

TLAAs that need to be addressed are not necessarily those analyses that have been previously reviewed or approved by the NRC. The following examples illustrate TLAAs that need to be addressed that were not previously reviewed and approved by the NRC:

- The FSAR states that the design complies with a certain national code and standard. A review of the code and standard reveals that it calls for an analysis or calculation. Some of these calculations or analysis will be TLAAs. The actual calculation was performed by the applicant to meet the code and standard. The specific calculation was not referenced in the FSAR. The NRC had not reviewed the calculation. In response to a generic letter~~,~~ (GL), a licensee submitted a letter to the NRC committing to perform a TLAA that would address the concern in the ~~generic letter.~~GL. The NRC had not documented a review of the applicant'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 set forth in 10 CFR 54.3 (and repeated in Subsection 4.1.2) 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 generic TLAAs that are included in the SRP~~-LR.~~-SLR. Table 4.7-1~~-3~~ in SRP-SLR Section 4.7 provides ~~a list~~examples of~~ other~~ potential plant-specific TLAAs that have been identified by license renewal applicants~~.~~ (LRA). It is not expected that all applicants would identify all the analyses in these tables as TLAAs for their plants. Also, an applicant may perform specific TLAAs for its plant that are not shown in these tables.

Criterion 3 for TLAAs in 10 CFR 54.3(a) establishes that, as one of the six criteria that are used to define a given analysis as a TLAA, the analysis has to involve time-limited assumptions defined by the current operating term (e.g., 40 years). Therefore, for proposed SLR applications, there may be instances where an existing, time-dependent analysis did not conform to Criterion 3 for TLAAs in 10 CFR 54.3(a) for the current period of extended operation, but would conform to this criterion for the subsequent period of extended operation that is requested for NRC approval. Therefore, the reviewer should perform a review of the CLB to determine whether there are any existing analyses for the CLB that will need to be identified as analyses that conform to Criterion 3 for TLAAs for the proposed subsequent period of extended operation even though the analyses did not conform to Criterion 3 for TLAAs for the previous period of extended operation that was approved in the renewed operating license for that period. For those cases where the addition of a proposed subsequent period of extended operation would cause a given analysis to conform to Criterion 3 for TLAAs in 10 CFR 54.3(a), the reviewer should assess whether the analysis also conforms to the remaining five criteria for identifying TLAAs in 10 CFR 54.3(a), and determine whether the analysis needs to be identified as a TLAA for the subsequent period of extended operation in accordance with the requirement in 10 CFR 54.21(c)(1).

As appropriate, NRC staff ~~members~~ from other branches of the Office of Nuclear Reactor Regulation (NRR) review the application in their assigned areas without examining the identification of TLAAs. However, they may come across situations in which they may question why the applicant did not identify certain analyses as TLAAs. The reviewer coordinates the resolution of any such questions with these other NRC staff ~~members~~ to determine whether these analyses should be evaluated as TLAAs.

In order to determine whether there is reasonable assurance that the applicant has identified the TLAAs for its plant, the reviewer should find that the analyses omitted from the applicant's list are not TLAAs. Should an applicant identify a TLAA that is also a basis for a plant-specific exemption that was granted pursuant to 10 CFR 50.12 and the exemption is in effect for the current operating period, the reviewer verifies that the applicant also has 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~~ Examples of an exemptions that may have been granted in accordance with 10 CFR 50.12 and based on a TLAA are those NRC-granted exemptions that approved American Society of Mechanical Engineers (ASME) Code N-514 as an alternative basis for complying with the pressure lift and system enable temperature setpoint requirements for PWR low temperature overpressure protection systems in 10 CFR Part 50, Appendix G and the ASME Code Section XI, Appendix G.

4.1.4 Evaluation Findings

The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of this section, and whether the NRC staff's evaluation supports conclusions of the following type, to be included in the ~~staff's safety evaluation report~~SER:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided an acceptable list of 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 are used by the NRC staff to evaluate conformance with NRC regulations.

4.1.6 References

1. NEI. NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54~~—~~–The License Renewal Rule~~,"~~." Revision 6. Washington, DC: Nuclear Energy Institute~~, Revision 6.~~. 1995.

2. NRC. NUREG~~-~~–0800, "Standard Review Plan for the Review of Safety Analysis Reports Nuclear Power Plants~~,"~~." Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. March 2007.

3. NRC. "Nuclear Power Plant License Renewal; Revisions." *Federal Register:* Vol. 60. No. 88, pp. 22,461–22,495. May 8, 1995

Table 4.1-1. Sample Process for Identifying Potential Time-Limited Aging Analyses (TLAA) 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.~~**Example of an analysis that meets all six of the criteria in 10 CFR 54.3(a) for defining an analysis as a TLAA:** The current licensing basis (CLB) includes a time-dependent fatigue flaw growth analysis for the reactor coolant pump (RCP) flywheels. An age-related fatigue failure of flywheels could potentially be a source of missiles that have the potential to impact the structural integrity and pressure retaining function of the reactor coolant pressure boundary. The applicant has identified that the RCP flywheels are components that meet the scoping definition in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.4(a)(1), in that the flywheels assure adequate heat removal during a plant trip and loss of power to the RCPs, as well as initiation of natural circulation flow as part of necessary safe shutdown activities. The applicant has not included the RCP flywheels are components that need to be within the scope of an aging management review (AMR), as would otherwise be required in accordance with 10 CFR 54.21(a)(1). The analysis is referenced in the updated final safety analysis report UFSAR and is based on design basis transients that are assumed and evaluated in the UFSAR based on a 40-year design life. The analysis is relied upon to establish a 10-year augmented inservice inspection interval for performing inspections of RCP flywheels and to demonstrate that fatigue-induced growth of a flaw in the flywheels would not result in a flywheel missile that could threaten the structure integrity of the reactor coolant pressure boundary during the life of the plant.
Criterion in 10 CFR 54.3(a)	*Disposition Basis for Comparing to the Criterion in 10 CFR 54.3(a)*
~~Maximum wind speed of 100 mph is expected to occur once per 50 years.~~Criterion 1: *The analysis must involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a).*	~~Not a TLAA because it does not involve an aging effect.~~Although the RCP flywheels are active components and do not need to be subjected to an AMR (as defined in 10 CFR 54.21(a)(1)), the components are within the scope of license renewal application because their failure could impact the intended pressure retaining function of a component that is located in the reactor coolant pressure boundary (RCPB). Therefore, the fatigue flaw growth analysis does conform to Criterion 1 in 10 CFR 54.3(a) because the flywheels do need to be within the scope of license renewal as a component whose failure could impact the intended function of a component that has been scoped in for renewal in accordance with 10 CFR 54.4(a)(1).
Criterion 2: *The analysis must consider the effects of aging.*	The fatigue flaw growth analysis for the RCP flywheels does meet Criterion 2 because the analysis assumes the presence of a postulated crack in the components and assumes that an age-related growth mechanism (fatigue flaw growth) will grow the flaw under the assumed transient loading conditions for the analysis.
Criterion 3: *The analysis must involve time-limited assumptions defined by the current operating term (for example, 40 years).*	The fatigue flaw growth analysis for the RCP flywheels does meet Criterion 3 because the analysis assumes that the loading conditions that induced fatigue flaw growth in the flywheel discs are based on the 40-year cyclic transient assumptions for specific design transients in the UFSAR. The 40-year cyclical nature of this assumption defines this analysis as one that involves time-limited assumptions defined by the current operating term.

Criterion 4: *The analysis must be determined to be relevant by the licensee in making a safety determination.*	The analysis conforms to Criterion 4 because the applicant is relying on the fatigue flaw growth analysis to establish a safety-related decision at the facility, which amounts to the applicant's safety decision to perform augmented inservice inspection of the RCP flywheels on a 10-year inservice inspection interval and relates to the applicant's basis for maintaining the integrity of the reactor coolant pressure boundary during the life of the plant.
Criterion 5: *The analysis must involve conclusions or provide the basis for conclusions related to the capability of the system, structure, or component to perform its intended function(s), as delineated in 10 CFR 54.4(b).*	The analysis conforms to Criterion 5 because the analysis evaluates the structural integrity of the RCP flywheels for fatigue-induced growth to ensure the integrity of the flywheels will be maintained during the licensed period of operation for the facility and that the integrity of the reactor coolant pressure boundary will be protected against the consequences of postulated flywheel missiles during the life of the plant.
Criterion 6: *The analysis is contained or incorporated by reference in the CLB.*	The analysis conforms to Criterion 6 because the analysis is referenced in the UFSAR for the facility.
Example of analyses that do not meet the six of the criteria for TLAAs in 10 CFR 54.3(a):	
~~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.~~Example of an analysis that does not meet Criterion 1 in 10 CFR 54.3(a): *The analysis must involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a).*	~~The membrane was not credited in any safety evaluation, and therefore the analysis is not considered a TLAA. This example does not meet criterion (4) of the TLAA definition in 10 CFR 54.3.~~The CLB includes a time-dependent corrosion analysis for both a refueling water storage tank (RWST) and a standby RWST that is included in the plant design. The applicant can align the standby RWST to the safety injection system and containment spray system for the facility during a postulated loss of coolant accident and the applicant has performed a 40-year time-dependent corrosion analysis of both the RWST and standby RWST. The RWST is credited as a safety-related component that is credited for accident mitigation objectives in the plant's accident analyses that are defined and evaluated in the UFSAR. In contrast, the standby RWST is not credited for accident mitigation in the accident analyses defined in the UFSAR. A postulated failure of the standby RWST does not have the ability to impact the intended function [as defined in 10 CFR 54.4(b)] of any safety-related component or structure that is required to be scoped in for renewal in accordance with 10 CFR 54.4(a)(1); nor is the standby RWST within the scope of any special regulations, as defined in 10 CFR 54.4(a)(3). The applicant has not identified the standby RWST as a tank that is within the scope of license renewal. Although the corrosion analysis for the standby RWST is part of the plant design, the analysis does not apply to a plant component that is within the scope of the SLRA because the component is not required to be within the scope of the license renewal application in accordance with 10 CFR 54.4 (a)(1), (a)(2), or (a)(3). Therefore, under this example, the corrosion analysis for the standby RWST does meet Criterion 1 in 10 CFR 54.3(a) and does not meet the definition of a TLAA in the 10 CFR Part 54 rule.

Example of an analysis that does not meet Criterion 2 in 10 CFR 54.3(a): *The analysis must consider the effects of aging.*	The CLB and design basis includes a stress analysis for a reactor coolant loop elbow that is compared to American Society of Mechanical Engineers (ASME) Code Section III allowable stress values. The stress analysis is performed in accordance with ASME Section III requirements, as invoked by 10 CFR 50.55a requirements. Although the stress analysis is required by the U.S. Nuclear Regulatory Commission (NRC) regulations and ASME Code requirements and is part of the CLB, it does not involve any analysis of an applicable or postulated aging effect. Therefore, under this example, the analysis does not conform to Criterion 2 in 10 CFR 54.3(a) and does not meet the definition of a TLAA in the 10 CFR Part 54 rule.
~~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.~~Example of an analysis that does not meet Criterion 3 in 10 CFR 54.3(a): *The analysis must involve time-limited assumptions defined by the current operating term (for example, 40 years).*	~~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 defined by the 40-year operating life for this component, which is the current operating term.~~The applicant has detected a flaw in one of its reactor vessel nozzle-to-safe end welds and has performed an ASME Code Section XI inservice inspection flaw growth analysis of the flaw in the components to justify further service of the impacted weld until the next outage in which the flaw would be inspected for acceptability, without the need of repair or replacement. The ASME-based flaw evaluation is part of the CLB and assumes the Class 1 design basis transients occur over a 20-year period from the time the flaw was detected. The analysis does not involve time-dependent assumptions defined by the current operating period because the assessment of design basis transient cycles was made on a time period less than that used for the current operating term. Therefore, under this example, the fatigue flaw analysis would not conform to Criterion 3 in 10 CFR 54.3(a) and would not meet the definition of a TLAA in the 10 CFR Part 54 rule.
Example of an analysis that does not meet Criterion 4 in 10 CFR 54.3(a): *The analysis must be determined to be relevant by the licensee in making a safety determination.*	The original licensing basis for a pressurized water reactor (PWR) included a high-energy line break (HELB) analysis for a piping location in the main reactor coolant loop that was based on ASME Section III cumulative usage factor (CUF) analysis requirements for high energy line break locations and demonstrated the need for inclusion of a pipe whip restraint in the design of the piping location. Subsequent to the performance of this analysis, the applicant submitted a leak-before-break (LBB) analysis for the main coolant loop piping that demonstrated conformance with the revised dynamic effect requirements in NRC General Design Criterion 4. The results of the LBB analysis demonstrated that the licensee would be capable of detecting a leak in the affected piping prior to a catastrophic failure of the component and that the pipe whip restraints could be removed from the design of the component. The LBB analysis was approved as part of an update of the CLB for the facility such that the HELB analysis is no longer relied upon as part of the CLB for this piping location. The original HELB analysis for this piping location is no longer relied upon for the CLB because it was replaced by the NRC-approved LBB analysis for the main coolant loops, which included these piping locations. Therefore, the original HELB analysis for this piping location is not relevant in making a safety determination relative to the inclusion of a pipe whip restraint on the piping component. Under this example, the HELB analysis for this specific piping location does not conform to Criterion 4 in 10 CFR 54.3(a) and does not meet the definition of a TLAA in the

	10 CFR Part 54 rule. HELB analyses for piping locations not excluded by LBB would still be relied upon for the CLB and would need to be identified as TLAAs for the LRA.
~~Containment tendon lift-off forces are calculated for the 40-year life of the plant. These data are used during Technical Specification surveillance for comparing measured to predicted lift-off forces.~~Example of an analysis that does not meet Criterion 5 in 10 CFR 54.3(a): *The analysis must involve conclusions or provide the basis for conclusions related to the capability of the system, structure, or component to perform its intended function(s), as delineated in 10 CFR 54.4(b).*	~~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 currently limited to 40-year values, and are needed to perform a required Technical Specification surveillance.~~The original licensing basis for a BWR included an evaluation of the number of paint coats that would be applied to the inside surfaces of its condensate storage tanks (CSTs). The CSTs have been included in the scope of the license renewal application in accordance with 10 CFR 54.4(a)(1) requirements and are within the scope of an applicable AMR, as performed in accordance with 10 CFR 54.21(a)(1) requirements. Although the coating analysis for the inside surfaces of the CST is discussed in the UFSAR, the UFSAR states that the analysis is not relied upon for the structural integrity of the CST or for drawing a conclusion that the CST will fulfill its accident mitigation and safe shutdown functions. Although the coating analysis is part of the design basis, it is not used to draw a conclusion or provide the basis for concluding that the structural integrity of the CST walls will be maintained during the design life of the plant or the ability of the CST coolant inventory to meet the accident mitigation or safe shutdown objectives for the plant design. Therefore, the coating analysis for the CST does not involve conclusions or provide the basis for conclusions related to the capability of the CST to perform its intended functions, as defined in 10 CFR 54.4(b). Under this example, the coating analysis for the CST does not conform to Criterion 5 in 10 CFR 54.3(a) and does not meet the definition of a TLAA in the 10 CFR Part 54 rule.
Example of an analysis that does not meet Criterion 6 in 10 CFR 54.3(a): *The analysis is contained or incorporated by reference in the CLB.*	The CLB for a PWR includes a plant-specific, probabilistic main turbine missile analysis that is used as basis for meeting 10 CFR Part 50, Appendix A, dynamic effect analysis design requirements, as given in General Design Criterion 4, "*Dynamic Effects*." This analysis is described and evaluated in the UFSAR, and states that the analysis was performed to demonstrate the main turbines will not generate a missile that could threaten the integrity of safety-related structures and components in the facility. The UFSAR indicates that the probabilistic turbine missile analysis was performed in lieu of a generic time-dependent turbine missile analysis that is provided in a specific vendor report and that meets all six of the criteria for defining TLAAs in 10 CFR 54.3(a). In this case, although the generic time dependent turbine missile analysis in the vendor report could have been relied upon for the CLB, the applicant does not rely on the analysis in this report as its basis for meeting General Design Criterion 4 requirements in 10 CFR Part 50, Appendix A. Therefore, the generic analysis in the vendor report is not contained or incorporated by reference in the CLB. Under this example, the generic turbine missile

	analysis in the vendor report does not conform to Criterion 6 in 10 CFR 54.3(a) and does not meet the definition of a TLAA in the 10 CFR Part 54 rule.

Table 4.1-2. Generic Time-Limited Aging Analyses	
Reactor Vessel Neutron Embrittlement (Subsection 4.2)	Neutron Fluence
	Pressurized Thermal Shock (PWRs Only)
	Upper Shelf Energy (PWRs and BWRs)
	Pressure Temperature (P-T) Limits (PWRs and BWRs)
	Low Temperature Overpressure Protection System Setpoints (PWRs Only)
	Ductility Reduction Evaluation for Reactor Internals (B&W designed PWRs only)
	RPV Circumferential Weld Relief–Probability of Failure and Mean Adjusted Reference Temperature Analysis for the RPV Circumferential Welds (BWRs only)
	Reactor Vessel Axial Weld Probability of Failure and Mean Adjusted Reference Temperature Analysis (BWRs only)
Metal Fatigue (Subsection 4.3)	Metal Fatigue of Class 1 Components
	Metal Fatigue of Non-Class 1 Components
	Environmentally-Assisted Fatigue
	High Energy Line Break Analyses
	Cycle-dependent Fracture Mechanics or Flaw Evaluations
	Cycle-dependent Fatigue Waivers
Environmental Qualification of Electrical Equipment (Subsection 4.4)	
Concrete Containment Tendon Prestress (Subsection 4.5)	
~~Inservice local metal containment corrosion analyses~~Containment Liner Plate, Metal Containments, and Penetrations Fatigue (Subsection 4.6)	

~~**Table 4.1-3 Examples of Potential Plant-Specific TLAAs**~~
~~Intergranular separation in the heat-affected zone (HAZ) of reactor vessel low-alloy steel under austenitic SS cladding~~
~~Low-temperature overpressure protection (LTOP) analyses~~
~~Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps~~
~~Fatigue analysis of the reactor coolant pump flywheel~~
~~Fatigue analysis of polar crane~~
~~Flow-induced vibration endurance limit for the reactor vessel internals~~
~~Transient cycle count assumptions for the reactor vessel internals~~
~~Ductility reduction of fracture toughness for the reactor vessel internals~~
~~Leak before break~~
~~Fatigue analysis for the containment liner plate~~
~~Containment penetration pressurization cycles~~
~~Metal corrosion allowance~~
~~High-energy line-break postulation based on fatigue cumulative usage factor~~
~~Inservice flaw growth analyses that demonstrate structure stability for 40 years~~

4.2 Reactor ~~VESSEL NEUTRON EMBRITTLEMENT~~ Pressure Vessel Neutron Embrittlement Analysis

Review Responsibilities

Primary ~~-~~ —Branch responsible for the time-limited aging analysis (TLAA) issues

Secondary ~~-~~ —Branch responsible for reactor systems

4.2.1 Areas of Review

During plant service, neutron irradiation reduces the fracture toughness of ferritic steel in the reactor pressure vessel (RPV) beltline region of light-water nuclear power reactors~~.~~, where RPV beltline region is described in Regulatory Issue Summary (RIS) 2014-11. Areas of review to ensure that the ~~reactor vessel~~RPV has adequate fracture toughness to prevent brittle failure during normal and off-normal operating conditions are (a) upper-shelf energy, (b) pressurized thermal shock (PTS) for pressurized water ~~reactors~~reactor (PWRs), (c) heat-up and cool-down (pressure-temperature limits) curves, (d) ~~Boiling Water Reactor Vessel and Internals Project (~~BWRVIP~~)-~~-05 analysis for elimination of circumferential weld inspection and analysis of the axial welds, and (e) other plant-specific TLAAs on ~~reactor vessel~~RPV neutron embrittlement. The adequacy of the analyses for these five areas is reviewed for the subsequent period of extended operation.

~~The adequacy of the analyses for these five areas is reviewed for the period of extended operation.~~

The branch responsible for reactor systems reviews 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 delineate acceptable methods for meeting the requirements of the U.S. Nuclear Regulatory ~~Commission's (NRC's~~Commission (NRC) regulation in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c)(1~~).~~) (Refs. 2, 3).[1]

4.2.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1)(i~~) - (~~)–(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 extended operation; or

[1]For subsequent license renewal applications, the period of extended operation concerns the period of operation after the expiration of the renewed license (i.e., operation from 60 to 80 years).

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

For the first three areas of review for the analysis of ~~reactor vessel~~RPV neutron embrittlement, the specific acceptance criteria depend on the applicant’s choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii).

4.2.2.1.1 Neutron Fluence

Neutron fluence is the number of neutrons accumulated per unit area during a certain period of neutron irradiation. A RPV neutron fluence analysis involves time-limited assumptions (e.g., 40 years of original design life) and is used to determine the loss of fracture toughness due to neutron irradiation embrittlement of the RPV. Appendix H to 10 CFR Part 50 (Ref. 4) requires that an applicant must implement a RPV Surveillance program for a RPV if the peak neutron fluence at the end of the design life of the RPV exceeds a neutron fluence of 10^{17} n/cm^2 [E > 1 MeV]. The RPV neutron fluence analysis is also integral to other neutron embrittlement TLAAs [e.g., upper shelf energy and pressure-temperature (P-T) limits analyses] because neutron fluence is a fundamental parameter which is used to determine the level of neutron irradiation embrittlement of a RPV. As discussed above, the RPV neutron fluence analysis is important in making a safety determination for a RPV in terms of loss of fracture toughness due to neutron irradiation embrittlement.

Typically, the RPV neutron fluence analysis is described in the applicant's Final Safety Analysis Report (FSAR) or other design documents approved by NRC. In its subsequent license renewal application (SLRA), the applicant identifies (a) the neutron fluence for each beltline material at the end of extended license term, (b) the NRC staff-approved methodology used to calculate the neutron fluence or submits the methodology for NRC staff review, (c) whether the methodology is consistent with the guidance in NRC Regulatory Guide (RG) 1.190 (Ref. 5), and (d) how the neutron fluence is monitored during the subsequent period of extended operation. An applicant may take any one of the following three dispositions for the RPV neutron fluence analysis.

4.2.2.1.1.1 10 CFR 54.21(c)(1)(i)

A neutron fluence analysis typically accounts for planned operation by including assumptions regarding the neutron flux emitted from the core. The flux is integrated over time to yield the estimated fluence. Frequently, neutron fluence calculations will include projected fluence values for multiple periods of exposure, (e.g., 40, 60, and 80 calendar years). In order to use a disposition for fluence pursuant to 10 CFR 54.21(c)(1)(i), the applicant will demonstrate the existing RPV neutron fluence analysis, including the projected flux for planned operation, in the current licensing basis (CLB) remains valid during the subsequent period of extended operation. The fluence calculation will be re-evaluated to confirm its validity.

4.2.2.1.1.2 10 CFR 54.21(c)(1)(ii)

For a disposition in accordance with 10 CFR 54.21(c)(1)(ii), the applicant will provide new or updated calculations that address the fluence effects during the subsequent period of extended operation. The new or updated RPV neutron fluence analysis is evaluated to consider the subsequent period of extended operation in accordance with (1) NRC RG 1.190, or (2) a methodology that has been approved for use by the NRC.

4.2.2.1.1.3 10 CFR 54.21(c)(1)(iii)

In the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report AMP X.M2, "Neutron Fluence Monitoring," the NRC staff has evaluated an aging management program (AMP) for projecting and monitoring neutron fluence for the subsequent period of extended operation. The staff has determined that this program is acceptable to project and monitor neutron fluence for managing loss of fracture toughness due to neutron irradiation embrittlement of RPVs in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.2.1.2 Upper-Shelf Energy ~~(USE)~~

10 CFR Part 50 Appendix G (Ref. ~~1~~6) paragraph IV.A.1 requires that the ~~reactor vessel~~RPV beltline materials have a Charpy upper-shelf energy (USE) of no less than 68 J ~~(~~[50 ft-lb~~)~~] throughout the life of the ~~reactor vessel~~RPV, unless otherwise approved by the NRC. An applicant may take any one of the following three approaches.

4.2.2.1.~~1~~2.1 10 CFR 54.21(c)(1)(i)

The ~~reactor vessel~~RPV components evaluated in the existing ~~upper-shelf energy~~USE analysis or NRC-approved equivalent margins analysis (EMA) are ~~re-evaluated~~reevaluated to demonstrate that the existing analysis remains valid during the subsequent period of extended operation because the neutron fluence projected to the end of the subsequent period of extended operation is ~~bound~~bounded by the neutron fluence ~~assumed~~ in the existing NRC-approved USE or EMA analysis.

4.2.2.1.~~1~~2.2 10 CFR 54.21(c)(1)(ii)

The ~~reactor vessel~~RPV components evaluated in the existing ~~upper-shelf energy~~USE analysis or NRC-approved EMA are ~~re-evaluated~~reevaluated to consider the subsequent period of extended operation in accordance with 10 CFR Part 50, Appendix G.

10 CFR Part 50, Appendix G, Section IV.A.1 (the rule) requires applicants to take further corrective actions ~~for those cases~~ where the ~~75~~50 ft-lbs ~~(102 joules) unirradiated USE (UUSE) criterion or 50 ft-lbs (~~[68 joules~~)~~] end-of-life (EOL) USE criterion cannot be met ~~(i.e., when the respective UUSE value falls below 75 ft-lbs or the EOL USE falls below 50 ft-lbs).~~. When this occurs, the rule requires a licensee to submit a supplemental analysis for NRC approval ~~for any case where the UUSE value is less than 75 ft-lbs (102 joules) or where the projected EOL USE value for a given material is projected to be less than the 50 ft-lbs (68 joules) acceptance criteria at the expiration of the operating license. Thus, if the USE value for a PWR reactor vessel (RV) material, as projected to the expiration of the period of extended operation, falls below either the 50 ft-lbs (68 joules) acceptance criterion or the USE value criterion specified in a previously NRC-approved EMA, or where the percent-drop in USE value for a BWR RV material, as projected to the expiration of the period of extended operation, falls below that percent-drop in USE value approved by the NRC in its safety evaluation of the BWRVIP's generic EMA for BWRs, an~~. The applicant will need to submit a plant-specific engineering analysis (usually an EMA) for NRC approval as supplemental information for subsequent license renewal~~.~~ (SLR). Otherwise, failure to meet the USE requirements of 10 CFR Part 50, Appendix G for the ~~RV~~RPV materials as evaluated using the neutron fluence that are projected for the subsequent period of extended operation mandates imposition of additional commitments or license ~~condition~~conditions on USE for the ~~license renewal application.~~ SLRA.

4.2.2.1.~~1~~2.3 10 CFR 54.21(c)(1)(iii)

Acceptance criteria ~~under~~for accepting USE TLAAs in accordance with 10 CFR 54.21(c)(1)(iii) have yet to be developed. They 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 subsequent period of extended operation.

4.2.2.1.~~2~~3 Pressurized Thermal Shock (for PWRs)

For PWRs, 10 CFR 50.61 (Ref. ~~2~~7) requires that the ~~"~~reference temperature~~"~~ for ~~reactor vessel~~RPV beltline materials evaluated at ~~EOL fluence,~~ the neutron fluence corresponding to the end of the subsequent period of extended operation, reference temperature pressurized thermal shock (RT$_{PTS}$~~,~~), be less than the ~~"~~PTS screening criteria~~"~~ at the expiration date of the operating license, unless otherwise approved by the NRC. The ~~"~~PTS screening criteria~~"~~ are 132 °C ~~(~~[270 °F~~)~~] for plates, forgings, and axial weld materials, and 149 °C ~~(~~[300 °F~~)~~] for circumferential weld materials. Alternatively, the licensee may comply with the requirements of 10 CFR 50.61a (Ref. 8). The regulations require updating of the PTS assessment upon a request for a change in the expiration date of a facility's operating license, or whenever there is a significant change ~~of the~~in projected ~~material neutron fluence or change in the material properties in any of the reactor vessel beltline materials.~~values of RT$_{PTS}$. Therefore, the RT$_{PTS}$ value must be calculated for the entire ~~life~~licensed operating period of the facility, including the subsequent period of extended operation. If the analyses result in RT$_{PTS}$ values that exceed the PTS screening criteria at the end of the subsequent period of extended operation, the applicant is required to implement additional corrective actions as described in 10 CFR Part 50.61 or 10 CFR 50.61a. The PTS TLAA may be handled as follows.

4.2.2.1.~~2~~3.1 10 CFR 54.21(c)(1)(i)

The existing PTS analysis based on 10 CFR 50.61 remains valid during the subsequent period of extended operation because the neutron fluence projected to the end of the subsequent period of extended operation is bound by the neutron fluence assumed in the existing analysis. If the existing PTS analysis is based on 10 CFR 50.61a, the applicant demonstrates that the current analysis remains applicable for the subsequent period of extended operation.

4.2.2.1.~~2~~3.2 10 CFR 54.21(c)(1)(ii)

The PTS analysis is ~~re-evaluated~~reevaluated to consider the subsequent period of extended operation in accordance with 10 CFR 50.61~~. An analysis may be performed in accordance with NRC Regulatory Guide (RG) 1.154 (Ref. 3)~~ or 10 CFR 50.61a ~~(Ref. 16) if~~. If the analyses result in RT$_{PTS}$ values that exceed the PTS screening criteria at the end of the subsequent period of extended operation, the applicant is required to implement additional corrective actions as described in 10 CFR Part 50.61 ~~are projected to be exceeded during~~or 10 CFR 50.61a. If the existing PTS analysis is based on 10 CFR 50.61a, the applicant updates the submittal to reflect the subsequent period of extended operation.

4.2.2.1.~~2~~3.3 10 CFR 54.21(c)(1)(iii)

The NRC staff position for license renewal (LR) on this option is described in a May 27, 2004 letter from L.A. Reyes (EDO) to the Commission (Ref. ~~4~~9), which states that if the applicant does not extend the TLAA, the applicant provides an assessment of the ~~current licensing basis~~ CLB TLAA for PTS, a discussion of the flux reduction program implemented in accordance with 10 CFR 50.61(b)(3), if necessary, and an identification of the viable options that exist for managing the aging effect in the future.

4.2.2.1.~~3~~4 Pressure-Temperature ~~(P-T)~~ Limits

10 CFR Part 50, Appendix G (Ref. ~~1~~4) requires that the ~~reactor pressure vessel (~~RPV~~)~~ be maintained within established ~~pressure-temperature (P-T)~~P-T limits~~, including~~ during ~~any condition of~~ normal ~~operation. This includes heatup~~operating conditions of the plant (including heatups and ~~cooldown.~~cooldowns of the reactor and anticipated operational transients), and

during pressure tests and system leak tests. These limits specify the maximum allowable pressure as a function of reactor coolant temperature. As the ~~reactor pressure vessel~~RPV becomes embrittled and its fracture toughness is reduced, the allowable pressure (given the required minimum temperature) is reduced. Regulatory Issue Summary (RIS) 2014-11 clarifies issues that must be addressed in developing P-T limits (Ref. 1).

P-T limits are TLAAs for the application if the plant currently has P-T limit curves approved for the expiration of the current period of operation ~~(~~[i.e., ~~32~~ 54 effective full power year (EFPY) or some other licensed EFPY ~~values at~~ value defined for the expiration date of the current license~~).~~]. However, the P-T limits for the subsequent period of extended operation need not be submitted as part of the ~~LRA~~SLRA since the P-T limits need to be updated through the 10 CFR 50.90 licensing process when necessary for P-T limits that are located in the limiting conditions of ~~operation~~operations (LCOs) of the Technical Specifications (TS). For those plants that have approved pressure-temperature limit reports (PTLRs), the P-T limits for the subsequent period of extended operation will be updated at the appropriate time through the plant's Administrative Section of the TS and the plant's PTLR process. In either case, the 10 CFR 50.90 or the PTLR processes, which constitute the ~~current licensing basis~~CLB, will ensure that the P-T limits for the subsequent period of extended operation will be updated prior to expiration of the P-T limit curves for the current period of operation.

P-T limits may be handled as follows.

4.2.2.1.~~3~~4.1 10 CFR 54.21(c)(1)(i)

The applicant demonstrates (on a case-by-case basis) that existing P-T limits ~~are~~in the CLB will remain valid during the subsequent period of extended operation~~ because the neutron fluence projected to the end of the period of extended operation is bound by the fluence assumed in the existing analysis~~.

4.2.2.1.~~3~~4.2 10 CFR 54.21(c)(1)(ii)

The P-T limits are ~~reevaluated to consider~~updated for the subsequent period of extended operation in accordance with
10 CFR Part 50, Appendix G (Ref. ~~1).~~4) and the applicant's appropriate TS change process for updating the P-T limit curves.

For P-T limit curves that are included in and controlled by requirements in the limiting conditions of operations of the plant TS, the applicant submits the changes to the P-T limits as a license amendment request (i.e., a TS change request) for the LRA that is submitted in accordance with the requirements 10 CFR 54.22 and uses the license amendment submittal as the basis for accepting the TLAA in accordance with 10 CFR 54.21(c)(1)(ii).

For P-T limits that are controlled by Administrative Controls TS requirements and located in an NRC-approved PTLR, the applicant updates the P-T limits in accordance with the methodology or methodologies approved in the applicable Administrative Controls TS section for its PTLR process and submits the updated PTLR(s) containing the updated P-T limits to the NRC (as information) in accordance the reporting requirements in the applicable Administrative Controls TS section. The applicant uses the submittal of the updated PTLR as the basis for accepting the TLAA in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.2.1.~~3~~4.3 10 CFR 54.21(c)(1)(iii)

Updated P-T limits for the subsequent period of extended operation must be ~~available~~established and completed using the applicable TS change process for updating the P-T limit curves prior to ~~entering~~ the plant's entry into the subsequent period of extended operation. The 10 CFR 50.90 (Ref. 10) process for P-T limits located in the LCOs or the Administrative Controls Process for P-T limits that are administratively amended through a PTLR process can be considered adequate AMPs or aging management ~~programs~~activities within the scope of 10 CFR 54.21(c)(1)(iii), such that P-T limits will be maintained through the subsequent period of extended operation.

4.2.2.1.~~4~~5 Elimination of Boiling Water Reactor Circumferential Weld ~~Inspection (for~~ Inspections

~~1.1.7.6.2~~ Some boiling water reactors (BWRs)

~~Some BWRs~~ have an approved technical alternative, which eliminates the ~~reactor vessel~~RPV circumferential shell weld inspections from the Section XI program 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. 5-7). These assessments are performed through the 10 CFR 50.55a process. If the applicant indicates that relief from circumferential weld examination will be made under 10 CFR 50.55a(a)(3), the applicant will manage this TLAA~~. Approved technical alternatives for SLR have yet to be developed. They will be evaluated on a case-by-case basis to ensure that the aging effects will be managed in accordance with 10 CFR 54.21(c)(1~~)(iii).~~

~~1.1.7.6.2.1 4.2.2.1.4.1 10 CFR 54.21(c)(1)(iii)~~

~~An applicant for renewal of a license should address this issue by noting that it will be handled through a re-application under 10 CFR 50.55a(a)(3). An applicant for a license renewal to operate,~~) such ~~a BWR may provide justification to extend this relief into the~~that the intended function(s) will be maintained during the subsequent period of extended operation ~~in accordance with BWRVIP-74-A (Ref. 8), which is the revised and NRC-approved version of BWRVIP-74 (Ref. 9). The staff's review of BWRVIP-74 (Ref. 9) is contained in an October 18, 2001 letter to C. Terry, BWRVIP Chairman (Ref. 10). Appendix E of the staff's final safety evaluation report (FSER) (Ref. 10) conservatively evaluated BWR RPV's to have 64 effective full-power years (EFPY), which is 10 EFPY greater than the maximum of what is realistically expected for the end of the license renewal period. Since this is a generic analysis, a licensee relying on BWRVIP-74-A should provide plant-specific information to demonstrate that at the end of the renewal period, the circumferential beltline weld materials meet the limiting conditional failure probability for circumferential welds specified in Appendix E of the FSER (Ref. 10) and that operator training and procedures are utilized during the license renewal term to limit the frequency for cold over-pressure events to the amount specified in the NRC FSER (Ref. 10).~~ .

4.2.2.1.~~5~~6 BWR Axial Welds ~~(for~~

Those BWRs~~)~~ that have been approved to use the circumferential weld technical alternative also had to justify acceptable conditional probability of failure for their RPV axial shell weld examination coverage from the Section XI program for the current license term. Approved technical alternatives for SLR have yet to be developed. They will be evaluated on a case-by-case basis to ensure that the aging effects will be managed in accordance with 10 CFR 54.21(c)(1) such that the intended function(s) will be maintained during the subsequent period of extended operation.

~~The staff's SER contained in a letter to Carl Terry dated March 7, 2000, "Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report" (Ref. 11), discussed the staff's concern related to RPV failure frequency for axial welds and the BWRVIP's analysis of the RPV failure frequency of axial welds. These discussions are also presented in the staff's FSER of BWRVIP-74 (Ref. 10). The SER indicates that the RPV failure frequency due to failure of the limiting axial welds in the BWR fleet at the end of 40 years of operation is less than 5 x 10^-6 per reactor year, given the assumptions on flaw density, distribution, and location described in the SER. Since the BWRVIP analysis was generic, a licensee relying on BWRVIP-74-A should monitor axial beltline weld embrittlement. The applicant may provide plant-specific information to demonstrate that the axial beltline weld materials at the extended period of operation meet the criteria specified in the report or have a program to monitor axial weld embrittlement relative to the values specified by the staff in its March 7, 2000 (Ref. 11) letter.~~

4.2.2.2 ~~FSAR~~Final Safety Analysis Report Supplement

The specific criterion for meeting 10 CFR 54.21(d) is~~:~~

that the summary description of the evaluation of TLAAs for the subsequent period of ~~extended~~ operation in the FSAR supplement is appropriate, such that later changes can be controlled by 10 CFR 50.59~~.~~ (Ref. 11). The description contains information associated with the TLAAs regarding the basis for determining that the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

4.2.3 Review Procedures

For each area of review described in Subsection 4.2.1, the following review procedures should be followed.

4.2.3.1 Time-Limited Aging Analysis

For the first ~~three~~four areas of review for the analysis of ~~reactor vessel~~RPV neutron embrittlement, the review procedures depend on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii). For each area, the applicant's three options under section 54.21(c)(1) are discussed in turn~~, as follows~~.

The applicant may identify activities to be performed to verify the assumption basis of the neutron fluence calculations that are used to evaluate the RPV neutron embrittlement analyses. An evaluation of that verification activity is provided by the applicant in the SLRA. The reviewer assures that the applicant's verification activity is sufficient to confirm the calculation assumptions for the 80-year period. If the assumption basis is not verified, the applicant must reevaluate the analysis and take appropriate corrective actions as necessary, consistent with the requirements of the affected regulation.

4.2.3.1.1 ~~Upper-Shelf Energy~~*Neutron Fluence*

4.2.3.1.1.1 10 CFR 54.21(c)(1)(i)

The ~~projected ¼T~~reviewer confirms that the applicant's existing RPV neutron fluence ~~at the end of~~analysis remains valid during the subsequent period of extended operation~~ is reviewed to verify that it is bound by the fluence assumed in the existing upper-shelf energy analysis.~~

~~Neutron Fluence:~~. The reviewer also confirms that the applicant identifies (a) the neutron fluence ~~at the ¼T location~~ for each beltline material at the ~~expiration~~end of the ~~license renewal~~subsequent period of extended operation, (b) the NRC staff-approved methodology used to determine the neutron fluence or submits the methodology for NRC staff review, and (c) whether the methodology ~~follows~~is consistent with the guidance in NRC RG 1.190~~ (~~.(Ref. ~~15).~~ 5).

4.2.3.1.1.2 10 CFR 54.21(c)(1)(ii)

The reviewer confirms that the applicant adequately reevaluated its RPV neutron fluence analysis for the subsequent period of extended operation. As part of its review, the review confirms that the applicant identifies (a) the neutron fluence for each beltline material at the end of the subsequent period of extended operation, (b) the NRC staff-approved methodology used to determine the neutron fluence or submits the methodology for NRC staff review, and (c) whether the methodology is consistent with the guidance in NRC RG 1.190.

4.2.3.1.1.3 10 CFR 54.21(c)(1)(iii)

GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring" of the GALL-SLR Report provides an acceptable method to project and monitor RPV neutron fluence through the subsequent period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii). The NRC staff reviews an applicant's program for dispositioning the TLAA in accordance with the requirements in 10 CFR 54.21(c)(1)(iii) and the guidance in GALL-SLR Report AMP X.M2. Plant-specific approaches to projecting and monitoring neutron fluence will be evaluated on a case-by-case basis to ensure that the aging effects due to neutron irradiation embrittlement will be managed such that the intended functions(s) will be adequately maintained for the subsequent period of extended operation.

4.2.3.1.2 Upper-Shelf Energy

4.2.3.1.2.1 10 CFR 54.21(c)(1)(i)

The projected ¼T neutron fluence at the end of the subsequent period of extended operation is reviewed for all beltline materials to verify that it is bounded by the neutron fluence assumed in the existing NRC-approved USE or EMA analysis in the CLB.

4.2.3.1.2.2 10 CFR 54.21(c)(1)(ii)

The documented results of the revised ~~upper-shelf energy~~USE analysis (or revised EMA analysis, as applicable) based on the projected neutron fluence at the end of the subsequent period of extended operation are reviewed for compliance with 10 CFR Part 50, Appendix G. The applicant may use NRC RG 1.99 Rev. 2 (Ref. 12) ~~to project upper-shelf energy~~as the basis for using the ¼ T neutron fluence values for the reactor vessel beltline components (as projected to the end of the SLR period) to project the USE values for the reactor vessel beltline components at the end of the subsequent period of extended operation. The applicant also may use ASME Code Section XI Appendix K (Ref. 13) for the purpose of performing an equivalent margins analysis to demonstrate that adequate protection for ductile failure is maintained to the end of the subsequent period of extended operation. The NRC staff reviews the applicant's methodology for this evaluation. Branch Technical Position (BTP) MTEB 5-3, "Fracture Toughness Requirements," in Standard Review Plan (Ref. 14), Section 5.3.2, "Pressure Temperature Limits, Upper-Shelf Energy, and Pressurized Thermal Shock," provides additional NRC positions on estimations of USE values for ~~reactor vessel~~RPV beltline materials.

The NRC staff confirms that the applicant has provided sufficient information for all ~~Upper Shelf Energy (~~USE~~)~~ and/or equivalent margins analysis calculations for the subsequent period of extended operation as follows:

~~Neutron Fluence:~~ The applicant identifies ~~(a)~~ the neutron fluence at the ¼T location for each beltline material at the expiration of the ~~license renewal~~subsequent period~~, (b) the staff-approved methodology used to determine the neutron fluence or submits the methodology for staff review, and (c) whether the methodology follows the guidance in NRC RG 1.190 (Ref. 15).~~ of extended operation.

To confirm that the USE analysis meets the requirements of Appendix G of 10 CFR Part 50 (Ref. 6) at the end of the ~~license renewal~~subsequent period of extended operation, the NRC staff determines whether:

1. For each beltline material, the applicant provides the unirradiated ~~Charpy~~ USE~~,~~ and the projected ~~Charpy~~ USE at the end of the ~~license renewal~~subsequent period of extended operation, and whether the drop in ~~Charpy~~ USE was determined using the limit lines in Figure 2 of NRC RG 1.99, ~~Revision~~Rev 2, based on the material copper content, or from surveillance data ~~and the percentage copper~~.

2. If an equivalent margins analysis is used to demonstrate compliance with the USE requirements in Appendix G of 10 CFR Part 50, the applicant provides the analysis or identifies an NRC-approved topical report that contains the analysis~~.~~ which is applicable to the subsequent period of extended operation. Information the NRC staff considers to assess the equivalent margins analysis includes the unirradiated USE (if available) for the ~~limiting~~ material, its copper content, the neutron fluence (¼T and at 1-inch depth), the ~~EOLE~~projected SLR USE ~~(if available),~~, the operating temperature in the downcomer at full power, the vessel radius, the vessel wall thickness, the J-applied analysis for Service Level C and D, the vessel accumulation pressure, and the vessel bounding heatup/cooldown rate during normal operation.

~~For Boiling Water Reactors, the staff confirms that the beltline materials are evaluated in accordance with Renewal Applicant Action Item 10 in the staff's SER for BWRVIP-74 (Letter to C. Terry dated October 18, 2001) (Ref.10). Action Item 10: To demonstrate that the beltline materials meet the Charpy USE criteria specified in Appendix B of BWRVIP-74-A or the NRC FSER (Ref. 10), the applicant demonstrates that the percent reduction in Charpy USE for their beltline materials is less than that specified for the limiting BWR/3-6 plates and the non-Linde 80 submerged arc welds and that the percent reduction in Charpy USE for their surveillance weld and plate are less than or equal to the values projected using the methodology in NRC RG 1.99, Revision 2.~~

~~The applicant identifies whether there are two or more surveillance material samples available that are relevant to the RPV beltline materials. If there are two or more data points for a surveillance material, the applicant provides analyses of the data to determine whether the data are consistent with the NRC RG 1.99, Revision 2 methodology that was utilized in the BWRVIP-74-A analyses.~~

4.2.3.1.~~1~~2.3 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 subsequent period of extended operation is reviewed on a case-by-case basis.

4.2.3.1.3~~.1.2~~ Pressurized Thermal Shock (for PWRs)

4.2.3.1.~~2~~3.1 10 CFR 54.21(c)(1)(i)

The projected clad-to-base metal interface neutron fluence at the end of the subsequent period of extended operation is reviewed to verify that it is ~~bound~~bounded by the neutron fluence assumed in the existing PTS analysis.

~~Neutron Fluence: The applicant identifies~~For PTS analysis based on a NRC-approved submittal based on 10 CFR 50.61a, the applicant demonstrates that the analysis bounds the subsequent period of extended operation.

4.2.3.1.3.2 10 CFR 54.21(c)(1)(ii)

The documented results of the revised PTS analysis based on the projected neutron fluence at the end of the subsequent period of extended operation are reviewed for compliance with 10 CFR 50.61or 10 CFR 50.61a.
(Ref. 7, 8)

The NRC staff confirms that the applicant has provided sufficient information for PTS for the subsequent period of extended operation as follows:

> The applicant identified the neutron fluence at the clad-to-base metal interface for each beltline material at the expiration of the ~~license renewal period. The applicant identifies the staff-approved methodology used in determining the neutron fluence or submits the methodology for staff review and identifies whether the methodology followed the guidance in NRC RG 1.190 (Ref. 15).~~subsequent period of extended operation.

~~*1.1.7.6.2.2 4.2.3.1.2.2 10 CFR 54.21(c)(1)(ii)*~~

~~The documented results of the revised PTS analysis based on the projected neutron fluence at the end of the period of extended operation are reviewed for compliance with 10 CFR 50.61.~~

~~The staff confirms that the applicant has provided sufficient information for Pressurized Thermal Shock for the period of extended operation as follows:~~

~~Neutron Fluence: Identified the neutron fluence at the clad-to-base metal interface for each beltline material at the expiration of the license renewal period. Identified the staff-approved methodology used in determining the neutron fluence or submit the methodology for staff review and identified whether the methodology followed the guidance in NRC RG 1.190 (Ref. 15).~~

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 subsequent period of extended operation. RT_{NDT} is the reference temperature (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 the facility's operating license.

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 neutron 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. A surveillance datum consists of a measured delta RT_{NDT} for corresponding neutron fluence. 10 CFR 50.61 specifies a procedure and a criterion for determining whether the surveillance data are credible. For the surveillance data to be defined as credible, the difference in the predicted value and the measured value for delta RT_{NDT} must be less than −2.2 °C [28 °F] for weld metal. When a credible surveillance data set exists, the chemistry factor can be determined from these data in lieu of a value from the table in 10 CFR 50.61. Then the standard deviation of the increase in the RT_{NDT} can be reduced from −2.2 °C [28°F] to −10 °C [14°F] for welds.

To confirm that the ~~Pressurized Thermal Shock~~PTS analysis results in RT_{PTS} values below the screening criteria in
10 CFR 50.61 at the end of the ~~license renewal~~subsequent period of extended operation, the applicant provides the following:

1. For each beltline material, provide the unirradiated RT_{NDT}, the method of calculating the unirradiated RT_{NDT} (either generic or plant-specific), the margin, ~~the~~ chemistry factor, the method of calculating the chemistry factor, the mean value for the shift in transition temperature, and the RT_{PTS} value.

2. If there are two or more data for a surveillance material that is from the same heat of material as the beltline material, provide analyses to determine whether the data are credible in accordance with NRC RG 1.99, ~~Revision~~Rev 2 (Ref. 12) and whether the margin value used in the analysis is appropriate.

3. If a surveillance program does not include the vessel beltline controlling material but two or more data seta are available from other beltline materials, then provide an analysis of the data in accordance with ~~Regulatory Guide~~NRC RG 1.99, ~~Revision~~Rev 2, Regulatory Position C.2.1, to show that the results either bound or are comparable to the values that would be calculated for the same materials using Regulatory Position C.1.1.

If the PTS screening criteria in 10 CFR 50.61 are projected to be exceeded during the subsequent period of extended operation, an analysis based on NRC RG 1.154 (Ref. ~~3~~15) or 10 CFR 50.61a may be submitted for review. For applicants with PTS analysis based upon an NRC-approved submittal using 10 CFR 50.61a, the analysis is revised to reflect the subsequent period of extended operation.

4.2.3.1.~~2~~3.3 10 CFR 54.21(c)(1)(iii)

The NRC staff reviews the applicant's proposal to demonstrate that the effects of aging on the intended function(s) will be adequately managed for the subsequent period of extended operation will be reviewed on a case-by-case basis.

~~The license renewal application~~If corrective actions are necessary, the NRC staff ensures that the SLRA provides an assessment of the ~~current licensing basis~~CLB TLAA for PTS, a discussion of the flux reduction program implemented in accordance with §50.61(b)(3), if necessary, and an identification of the viable options that exist for managing the aging effect in the future. As part of this review, the staff ensures that the applicant addressed the following topics:

A. The applicant explains its core management plans (e.g., operation with a low leakage core design and/or integral burnable neutron absorbers) from now through the end of the subsequent period of extended operation. Based on this core management strategy, the applicant:

(1) Identifies the material in the RPV which has limiting RT_{PTS} value,

(2) Provides the projected neutron fluence value for the limiting material at end of ~~license~~the subsequent period of extended ~~(EOLE),~~operation,

(3) Provides the projected RT_{PTS} value for the limiting material at ~~EOLE,~~ end of the subsequent period of extended operation, and

(4) Provides the projected date and neutron fluence values at which the limiting material will exceed the screening criteria in §50.61.

B. The applicant discusses the AMPs or aging management ~~programs~~activities that it intends to implement, which actively "manage" the condition of the facility's RPV and hence, the risk associated with PTS. This discussion is expected to address, at least, the facility's reactor pressure vessel material surveillance program.

C. If corrective actions are necessary, the applicant briefly discusses the options that it is considering with respect to "resolving" the PTS issue through ~~EOLE.~~end of the subsequent period of extended operation. It is anticipated that this discussion includes some or all of the following:

(1) Plant modifications ~~(~~[e.g., heating of emergency core cooling system (ECCS) injection water~~)~~] which could limit the risk associated with postulated PTS events [see §50.61(b)(4) and/or (b)(6)],

(2) More detailed safety analyses ~~(e.g., using Regulatory Guide 1.154)~~ which may be performed to show that the PTS risk for the facility is acceptably low through ~~EOLE~~end of the subsequent period of extended operation [see §50.61(b)(4)],

(3) More advanced material property evaluation (e.g., use of Master Curve technology) to demonstrate greater fracture resistance for the limiting material [applies to §50.61(b)(4)],

(4) The potential for RPV thermal annealing in accordance with §50.66 [see §50.61(b)(7)], and/or

(5) Use of the alternative PTS Rule (Ref. ~~16~~8).

4.2.3.1.~~3~~4 Pressure-Temperature ~~(P-T)~~ Limits

~~*1.1.7.6.2.3 4.2.3.1.3.1 10 CFR 54.21(c)(1)(i)*~~

The regulation in 10 CFR Part 50, Appendix G (Ref. 6) requires that the RPV be maintained within established P-T limits during normal operating conditions of the plant, including heatups and cooldowns of the reactor and anticipated operational transients, and during pressure test and system leak test conditions. These limits specify the maximum allowable pressure as a function of reactor coolant temperature. As the RPV becomes embrittled and its fracture toughness is reduced, the allowable pressure (given the required minimum temperature) is reduced.

The regulation in 10 CFR 50.36 (Ref. 16) requires that P-T limits be controlled by plant TS; however, the process for performing updates of the P-T limits depends on whether the P-T limit curves for the facility are maintained in the Limiting Conditions of Operation Section of the TS (i.e., in the TS LCOs) or in a PTLR that is controlled and updated in accordance with the Administrative Controls Section of the plant TS (i.e., by an Administrative Controls TS Section). P-T limits are TLAAs for the application if the plant currently has P-T limit curves approved for the expiration of the current period of operation (i.e., 32 EFPY or some other licensed EFPY value defined for the expiration date of the current license). However, as stated in SRP-SLR Section 4.2.2.1.3, the assessment of P-T limit TLAAs for incoming LRAs and basis for accepting the TLAAs under the requirements of 10 CFR 54.21(c)(1)(i), (ii) or (iii) is somewhat dependent on the process that is used for updating the P-T limits.

For P-T limits that are located in the TS LCOs and are controlled by the 10 CFR 50.90 license amendment process, the P-T limits are required to be updated and approved by the NRC prior to expiration of the current P-T limit curves in the TS LCOs, or when a change to the P-T limits is needed for compliance with the requirements in Section IV.C of 10 CFR Part 50, Appendix H (Ref. 4). For those plants that have approved PTLRs, the P-T limits are required to be updated prior to expiration of the current P-T limit curves in the PTLRs, or when a change to the P-T limits is needed for compliance with the requirements in Section IV.C of 10 CFR Part 50, Appendix H, or when required by a specific P-T limits update clause in the Administrative Controls TS Section that governs implementation of the PTLR process.

Specifically, for plants with approved PTLRs, the Administrative Controls TS Section governing the PTLR process requires that the update of the P-T limits be accomplished using prescribed methodologies referenced in the TS requirements. NRC generic letter (GL) 96-03 (Ref. 17) provides the NRC's position on the minimum requirements that need to be included in the Administrative Controls TS Section that governs implementation of the PTLR process and the type of information that need to be included in the NRC-approved methodologies that will be used to update the P-T limits and PTLRs. The GL identifies that 10 CFR 50.90 license amendment requests are not necessary for updates of the P-T limit curves if the required methodologies are used to update the P-T limits in the PTLRs. Since GL 96-03 establishes the NRC's position on what needs be included within the scope of the P-T limit methodologies, applicants with approved PTLRs may want to verify that the P-T limit methodologies referenced in the applicable Administrative Controls TS Section for their PTLR processes are still in conformance with the criteria in GL 96-03 and that a resulting 10 CFR 54.22 (Ref. 18) change of the TS is not needed for their LRAs. If it is determined that a change to the referenced methodologies is needed for the LRA, the applicant should submit the changes to the referenced methodologies as part of a 10 CFR 54.22 implemented license amendment and TS change request for the LRA.

4.2.3.1.4.1 10 CFR 54.21(c)(1)(i)

If the P-T limits are located in the TS LCOs or the PTLRs (whichever is applicable to CLB) and the applicant selects the 10 CFR 54.21(c)(1)(i) option as the basis for accepting the TLAA, the projected neutron ~~fluence~~fluences for the ¼T and ¾T locations of each of the RPV beltline components at the end of the subsequent period of extended operation are reviewed to confirm that they are bounded by the neutron fluences used to develop the existing P-T limit analysis.

~~Neutron Fluence: The applicant identifies (a) the neutron fluence at the ¼T and ¾T locations for each beltline material at the expiration of the license renewal period, (b) the staff-approved methodology used to determine the neutron fluence or submits the methodology for staff review, and (c) whether the methodology follows the guidance in NRC RG 1.190 (Ref. 15).~~

4.2.3.1.~~3~~4.2 10 CFR 54.21(c)(1)(ii)

The documented results of the revised P-T limit analysis based on the projected reduction in fracture toughness at the end of the subsequent period of extended operation is reviewed for compliance with 10 CFR Part 50, Appendix G. If the P-T limits are controlled by the TS LCOs, the reviewer confirms that the updated P-T limits for the facility are submitted as a 10 CFR 54.22 required license amendment and TS change request for the facility. The reviewer reviews the submitted P-T limit analysis for compliance with requirements in 10 CFR Part 50, Appendix G. If the P-T limits are controlled by an applicable Administrative Control TS Section and a PTLR process, the updated P-T limits are reviewed to confirm that the updated P-T limits have been submitted in an updated PTLR that has been included with the LRA. The P-T limits in the updated PTLR are also reviewed to confirm that the P-T limits have been calculated in accordance with the methodologies referenced in the applicable Administrative Controls TS Section for the PTLR process, or if not, that the updated methodology or methodologies used to generate the updated P-T limits in the PTLR has or have been submitted as part of a 10 CFR 54.22 implemented license amendment and TS change request for the LRA.

The P-T limit evaluations are dependent upon the neutron fluence.

~~Neutron Fluence: The applicant identifies (a) the neutron fluence at the ¼T and ¾T locations for each beltline material at the expiration of the license renewal period, (b) the staff-approved methodology used to determine the neutron fluence or submits the methodology for staff review, and (c) whether the methodology follows the guidance in NRC RG 1.190 (Ref. 15).~~

4.2.3.1.~~3~~4.3 10 CFR 54.21(c)(1)(iii)

Updated P-T limits for the subsequent period of extended operation must be ~~available~~established and implemented prior to ~~entering~~entry into the subsequent period of extended operation. The 10 CFR 50.90 (Ref. 10) process for P-T limits located in the TS LCOs or the TS Administrative Controls Process for P-T limits that are administratively amended through a PTLR process can be considered adequate ~~aging management programs~~AMPs within the scope of 10 CFR 54.21(c)(1)(iii), such that P-T limits will be maintained through the subsequent period of extended operation.

For ~~Boiling Water Reactors, the~~plants whose P-T limits are controlled by an applicable Administrative Controls TS Section and a NRC-approved PTLR process, the methodologies referenced in the applicable TS Section are reviewed to verify that they will comply with the requirements in 10 CFR Part 50, Appendix G and conform to the recommended position for minimum methodology contents in GL 96-03. Otherwise, the methodology bases for generating updates of the P-T limits during the subsequent period of extended operation are reviewed to determine whether a 10 CFR 54.22-implemented license amendment and TS change of the methodology requirements is necessary for the LRA.

For BWRs whose applicants are accepting their P-T limits in accordance with the criterion in 10 CFR 54.21(c)(1)(iii), the NRC staff confirms that the applicant addresses the following Renewal Applicant Action Item in the NRC staff's Safety Evaluation Report (SER) for BWRVIP~~-~~-74 (~~Letter to C. Terry dated October 18, 2001) (~~Ref.~~10~~ 19).

> Action Item 9: Appendix A of ~~the~~ BWRVIP-74-A ~~Report~~(Ref. 20) indicates that a set of P-T curves should be developed for the heat-up and cool-down operating conditions in the plant at a given EFPY in the ~~license renewal~~subsequent period of extended operation.

This means that, for this action item, the applicant has not provided updated curves, but shall have a procedure for updating P-T limits in accordance with 10 CFR Part 50, Appendix G, that will cover ~~60~~80 years.

4.2.3.1.~~4~~5 Elimination of Boiling Water Reactor Circumferential Weld Inspection ~~(for~~

Some BWRs~~)~~ have an approved technical alternative, which eliminates the RPV circumferential shell weld inspections from the Section XI program for the current license term. Approved technical alternatives for SLR have yet to be developed. They will be evaluated on a case-by-case basis to ensure that the aging effects will be managed in accordance with 10 CFR 54.21(c)(1) such that the intended function(s) will be maintained during the subsequent period of extended operation.

~~The staff verifies that the applicant has identified that, should the inspection relief be desired for the period of extended operation, an application will be made under 10 CFR 50.55a(a)(3) prior to entering the period of extended operation. If the applicant indicates that relief from circumferential weld examination will be made under 10 CFR 50.55a(a)(3), the applicant will manage this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).~~

~~*1.1.7.6.3 4.2.3.1.5 Axial Welds (for BWRs)*~~

~~To demonstrate that the vessel has not been embrittled beyond the basis for the staff and BWRVIP analyses, the applicant should provide (a) a comparison of the neutron fluence, initial RT_{NDT}, chemistry factor amounts of copper and nickel, delta RT_{NDT}, and mean RT_{NDT} of the limiting axial weld at the end of the license renewal period to the reference case in the BWRVIP and staff analyses and (b) an estimate of conditional failure probability of the RPV at the end of the license renewal term based on the comparison of the mean RT_{NDT} for the limiting axial welds and the reference case. If this comparison does not indicate that the RPV failure frequency for axial welds is less than 5×10^{-6} per reactor year, the applicant should provide a probabilistic analysis to determine the RPV failure frequency for axial welds. Consistent with the staff's supplemental safety evaluation report (SER) of BWR Vessel and Internals Project BWRVIP-05 Report, dated May 7, 2000 (Ref. 11), the staff should ensure that the applicant's plant is bounded by the BWRVIP-05 analysis or that the applicant has committed to a program to monitor axial weld embrittlement relative to the values specified by the staff in its May 7, 2000 SER. The staff also confirms that the applicant has addressed the following Renewal Applicant Action Item in the staff's SER for BWRVIP-74 (Letter to C. Terry dated October 18, 2001) (Ref.10).~~

~~Action Item 12: As indicated in the staff's March 7, 2000 letter to Carl Terry, a license renewal (LR) applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine the mean RT_{NDT} of the limiting axial beltline weld at the end of the extended period of operation is less than the values specified in Table 1 of the staff's Oct. 18, 2001 FSER (Ref. 10).~~

4.2.3.1.6 Boiling Water Reactor Axial Welds

Those BWRs that have been approved to use the circumferential weld technical alternative also had to justify acceptable conditional probability of failure for their RPV axial shell weld examination coverage from the Section XI program for the current license term. Approved technical alternatives for SLR have yet to be developed. They will be evaluated on a case-by-case basis to ensure that the aging effects will be managed in accordance with 10 CFR 54.21(c)(1) such that the intended function(s) will be maintained during the subsequent period of extended operation.

4.2.3.2 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer verifies that the applicant has provided information to be included in the FSAR supplement that includes a summary description of the evaluation of the ~~reactor vessel~~RPV 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 an FSAR supplement with information equivalent to that in Table 4.2-1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4~~).~~) (Ref. 21). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.

As noted in Table 4.2-1, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the ~~license renewal application~~SLRA to any future aging management activities, including enhancements and commitments to be completed before the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

4.2.4 Evaluation Findings

The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of this section and whether the NRC 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~~SER:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the ~~reactor vessel~~RPV neutron embrittlement TLAA, [choose which is appropriate] (i) the analyses remain valid for the subsequent period of extended operation, (ii) the analyses have been projected to the end of the

subsequent period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the subsequent period of extended operation. The NRC staff also concludes that the FSAR supplement contains an appropriate summary description of the ~~reactor vessel~~RPV neutron embrittlement TLAA evaluation for the subsequent period of extended operation as reflected in the license condition.

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 NRC staff in its evaluation of conformance with NRC regulations.

4.2.6 References

~~1. 10 CFR Part 50 Appendix G, "Fracture Toughness Requirements," Office of the Federal Register, National Archives and Records Administration, 2010.~~

1. ~~10 CFR~~NRC. Regulatory Information Summary (RIS) No. 2014-11, "Information on Licensing Applications For Fracture Toughness Requirements For Ferritic Reactor Coolant Pressure Boundary Components." ML14149A165. Washington, DC: U.S. Nuclear Regulatory Commission. October 14, 2014.

2. 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

3. 10 CFR Part 54.21, "Contents of Application–Technical Information." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

4. 10 CFR Part 50, "Appendix H, Reactor Vessel Material Surveillance Program Requirements." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

5. NRC. Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." Revision 0. Washington, DC: U.S. Nuclear Regulatory Commission. 2001.

6. 10 CFR Part 50, "Fracture Toughness Requirements." Appendix G. Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

~~2.~~7. 10 CFR Part 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events~~," Office of the Federal Register, National Archives and Records Administration, 2010~~." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

8. 10 CFR Part 50.61a, "Alternate Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events." Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

9. L.A. Reyes. Letter (May 27) to the Commission. ML041190564. Washington, DC: U.S. Nuclear Regulatory Commission. 2004.

10. 10 CFR Part 50.90, “Application for Amendment of License, Construction Permit, or Early Site Permit.” Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

11. 10 CFR Part 50.59, “Changes, Tests, and Experiments.” Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

12. NRC. Regulatory Guide 1.99, “Radiation Embrittlement of Reactor Vessel Materials.” Revision 2. May, 1988.

13. ASME. Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components, Nonmandatory Appendix K, “Assessment of Reactor Vessels with Low Upper Shelf Charpy Impact Energy Levels.” New York City, New York. 2010.

14. NRC. NUREG–0800, “U.S. Nuclear Regulatory Commission, Standard Review Plan.” Washington, DC: U.S. Nuclear Regulatory Commission. March 2007.

~~3.~~15. NRC. Regulatory Guide 1.154, “Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission~~,~~. January 1987.

~~4. Letter to the Commission from L.A. Reyes (EDO), dated May 27, 2004 (ADAMS accession number ML041190564)~~

~~5. BWRVIP-05, “BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations,” EPRI TR-105697, September 1995.~~

16. 10 CFR Part 50.36, “Technical Specifications.” Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

17. NRC. Generic Letter 96-03, “Relocation of the Pressure Temperature Limit Curves and Lower Temperature Overpressure Protection System Limits.” Washington, DC: U.S. Nuclear Regulatory Commission. 1996.

18. 10 CFR Part 54.22, “Contents of Application – Technical Specifications.” Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

~~6.~~ Christopher Grimes. Letter (October 18) to Carl Terry of Niagara Mohawk Power Company, BWRVIP Chairman~~, from Gus C. Lainas of NRC, “Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. M93925),” July 28, 1998.~~

~~7. 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,” U.S. Nuclear Regulatory Commission, November 10, 1998.~~

~~8. BWRVIP-74-A, “BWR Vessels and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal,” EPRI TR-1008872, June 2003.~~

~~9. BWRVIP-74, “BWR Vessels and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines,” EPRI TR-113596, September 1999.~~

~~10.~~19. ~~Letter to Carl Terry of Niagara Mohawk Power Company, BWRVIP Chairman, from Christopher Grimes, of NRC~~, “Acceptance for Referencing of EPRI Proprietary Report TR-113596, BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines BWRVIP-74), and Appendix A, Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10CFR54.21~~),” dated October 18,~~).” Washington, DC: U.S. Nuclear Regulatory Commission. 2001.

~~11. Letter to Carl Terry of Niagara Mohawk Power Company,~~ EPRI. TR-1008872, “BWRVIP ~~Chairman, from Jack R. Strosnider, Jr., of NRC, “Supplement to Final Safety Evaluation of the~~-74-A, BWR ~~Vessel~~Vessels and Internals Project ~~BWRVIP-05 Report (TAC No. MA3395),” dated March 7, 2000.12.~~

~~12.~~20. ~~Regulatory Guide 1.99 Rev. 2, “Radiation Embrittlement of~~, BWR Reactor ~~Vessel Materials,” May, 1988.~~ Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal.” Palo Aldo, California: Electric Power Research Institute. June 2003.

~~13. Appendix K of ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” 2004 Edition.~~

~~14.~~21. ~~NUREG-0800, “~~10 CFR Part 50.71, “Maintenance of Records, Making of Reports.” Washington, DC: U.S. Nuclear Regulatory Commission~~, Standard Review Plan,” U.S. Nuclear Regulatory Commission, March 2007~~. 2015.

~~15. Regulatory Guide 1.190 Rev. 0, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," U.S. Nuclear Regulatory Commission, March 2001.~~

~~16. 75 FR 23, "Alternative Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," January 4, 2010.~~

Table 4.2-1. Examples of FSAR Supplement for Reactor Vessel Neutron Embrittlement ~~TLAA Evaluation~~ Analyses

TLAA	Description of Evaluation	Implementation Schedule*
Neutron Fluence Example for acceptance per §54.21(c)(1)(iii)	The neutron fluence of each beltline material for the subsequent period of extended operation has been calculated in accordance with the guidance in RG 1.190. The neutron fluence is monitored through the subsequent period of extended operation by using GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring."	Ongoing through AMP monitoring
Upper-shelf energy Example for acceptance per §54.21(c)(1)(ii)	10 CFR Part 50 Appendix G paragraph IV.A.1 requires that the ~~reactor vessel~~RPV beltline materials must have Charpy upper-shelf energy of no less than 50 ft-lb (68 J) throughout the life of the ~~reactor vessel~~RPV unless otherwise approved by the NRC. The upper-shelf energy has been determined to exceed 50 ft-lb (68 J) to the end of the subsequent period of extended operation.	Completed
Pressurized thermal shock (for PWRs) Example for acceptance per §54.21(c)(1)(ii)	For PWRs, 10 CFR 50.61 requires the ~~"~~reference temperature RT_{PTS}~~"~~ for ~~reactor vessel~~RPV beltline materials to be less than the ~~"~~PTS screening criteria~~"~~ at the expiration date of the operating license unless otherwise approved by the NRC. ~~The "PTS screening criteria" are 270°F (132°C) for plates, forgings, and axial weld materials, or 300°F (149°C) for circumferential weld materials. The "~~ The reference temperature~~"~~ has been determined to be less than the ~~"~~PTS screening criteria~~"~~ at the end of the subsequent period of extended operation, unless alternate requirements have been invoked in accordance with 10 CFR 50.61(b) and approved by the NRC.	Completed
Pressure-temperature (P-T) limits Example for acceptance per §54.21(c)(1)(iii)	10 CFR Part 50 Appendix G requires that heatup and cooldown of the RPV be accomplished within established P-T limits. These limits specify the maximum allowable pressure as a function of reactor coolant temperature. As the RPV becomes embrittled and its fracture toughness is reduced, the allowable pressure is reduced. 10 CFR Part 50 Appendix G requires periodic update of P-T limits based on projected embrittlement and data from a material surveillance program. The P-T limits will be	For P-T limits controlled by TS LCOs: 10 CFR 50.90 Update should be completed and approved by the NRC before the subsequent period of

Table 4.2-1.	**Examples of FSAR Supplement for Reactor Vessel Neutron Embrittlement ~~TLAA Evaluation~~ Analyses**	
	updated to consider the subsequent period of extended operation.	extended operation For P-T limits controlled by TS PTLR requirements: Update should be completed before the subsequent period of extended operation and updated PTLR containing the updated P-T limits submitted to the NRC in accordance applicable Administrative Control TS reporting requirements
Elimination of BWR circumferential weld ~~inspection~~inspections and analysis of BWR axial welds ~~(for BWRs)~~	~~NRC has granted relief from the reactor vessel circumferential shell weld inspections because the applicant has demonstrated through plant-specific analysis that the plant meets the staff-approved BWRVIP-74-A Report and has provided sufficient information that the probability of vessel failure due to embrittlement of axial welds is low. If the applicant indicates that relief from circumferential weld examination will be made under 10 CFR 50.55a(a)(3), the applicant will manage this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).~~[Not applicable - approved technical alternatives for SLR have yet to be developed]	~~Re-submittal under 10 CFR 50.55a(a)(3) should be completed before the period of extended operation~~Not applicable
Other miscellaneous TLAAs on RV neutron embrittlement	Provide sufficient information on how the calculations for plant-specific TLAAs were performed, what the limiting TLAA parameter was calculated to be in accordance with the neutron fluence projected for the subsequent period of extended operation, and why the TLAA is acceptable under either 10 CFR 54.21 (c)(1)(i), (ii), or (iii).	
*An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the ~~license renewal application~~SLRA to any future aging management activities to be completed before the subsequent period of extended operation. The staff		

Table 4.2-1. Examples of FSAR Supplement for Reactor Vessel Neutron Embrittlement ~~TLAA Evaluation~~ **Analyses**
expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities by no later than the committed date.

4.3 Metal Fatigue

Review Responsibilities

Primary~~ - ~~—Branch responsible for the time-limited aging analysis (TLAA) issues

Secondary~~ - ~~—None

4.3.1 Area of Review

Fatigue occurs in a metal component ~~may progressively degrade and lose its structural integrity~~ when it is subjected to fluctuating ~~stresses, even~~loads. If the loading is of sufficient magnitude or frequency, cracks may initiate and propagate in the component at ~~magnitudes less than the design static loads, due to a well-known degradation mechanism -~~ the location of maximum loading. To address fatigue~~. This mechanism of degradation can occur in flaw-free components by developing cracks during services. ASME~~ concerns, Section III ~~(Ref. 1)~~ of the American Society of Mechanical Engineers (ASME) Code requires a fatigue analysis for Class 1 components~~ unless allowed by the Code to be exempted under applicable ASME Section III provisions.~~. The analysis ~~considers~~must consider all ~~transient~~ expected cyclic loads based on the anticipated number of ~~thermal and pressure transients, and includes~~ cyclic loadings. In the most rigorous evaluation, the ASME Code provisions include the calculation of ~~a parameter~~ “the cumulative usage factor” (CUF) ~~that is used~~ for ~~estimating the extent of~~ selected locations within a component, which is a calculated measure of the expended fatigue ~~damage~~initiation life at each location in the component. Under these provisions, the ASME Code limits the CUF to a value of less than or equal to ~~one~~unity for acceptable fatigue design. A CUF below a value of ~~one~~unity provides assurance that no crack has ~~been formed. A CUF above a~~ initiated at the analyzed location in the component. Other provisions in Section III of the ASME Code allow less rigorous treatment to address the fatigue design in components that have smaller or less frequent cyclic loadings, (i.e., fatigue waiver evaluation). In some cases, continued adequacy of the fatigue life of a component may be demonstrated through reinspections that continue to demonstrate an absence of fatigue flaws, (i.e., flaw tolerance evaluation). In other cases, the growth of fatigue flaws is assessed to ensure that flaws detected in components remain within allowable limits.

The acceptability of metal components from a fatigue standpoint is demonstrated by one or more relevant fatigue parameters, which include, but are not limited to, the CUF values, the environmentally-adjusted CUF_{en} values, transient cycle limits, and predicted flaw sizes (for fatigue flaw tolerance or component flaw evaluations). The limits of the fatigue parameters are established by the applicable fatigue analyses and may be a design limit, for example from an ASME Code fatigue evaluation, or an analysis-specific value~~ of one allows for the possibility that a crack may form, and that if left untreated, the crack could propagate exponentially under fatigue loading and eventually lead to coolant leakage in reactor pressure boundary components, or even general structural failure. Metal fatigue of components may have been evaluated~~, for example based on ~~an assumed~~the number of ~~transients or cycles for the current~~cyclic load occurrences assumed in fatigue waiver evaluations or the acceptable flaw sizes postulated in flaw tolerance or component flaw evaluations.

As a result of the assumptions used in the underlying evaluations associated with metal component fatigue parameters (i.e., the magnitude and frequency of the assumed cyclic loadings for the future operating ~~term. The~~ life of the component), the continued validity of ~~such~~ metal fatigue ~~analysis~~analyses is reviewed for the subsequent period of extended operation.

Areas of review to ensure that the metal component fatigue ~~or flaw growth/tolerance~~parameter evaluations are valid for the subsequent period of extended operation include:

1. CUF calculations ~~for ASME Code Class 1~~ or fatigue waiver evaluations for components designed ~~to ASME~~using the fatigue requirements of Section III ~~requirements, and~~ of the ASME Code or other Codes that ~~are based on~~use a ~~CUF~~I_t calculation [e.g., the 1969 edition of ANSI B31.7 ~~(Ref. 3)~~ for Class 1 piping, ASME NC-3200 vessels, ASME NE-3200 Class MC components, ASME NG-3200 core support structures, and metal bellows designed to ASME NC-3649.4(e)(3), ND-3649.4(e)(3), or NE-3366.2(e)(3~~)~~]~~. ASME Class 1 components, which include core support structures, are analyzed for metal fatigue.~~)] or the Draft ASME Code for Pumps and Valves for I_t analyses).

2. ~~Implicit~~ Fatigue-based maximum allowable stress calculations for ~~piping~~ components ~~designed~~evaluated to United States of America Standards (USAS) American National Standards Institute (ANSI) B31.1 ~~(Ref.~~ or ASME Code Class 2~~)~~ and 3 requirements~~, and ASME Code Class 2 and 3 components designed to ASME Section III design requirements that are similar to the guidance in ANSI B31.1.~~ .

~~ANSI B31.1 applies only to piping and does not call for an explicit fatigue analysis. It specifies allowable stress levels based on the number of anticipated full thermal range transient cycles. The specific stress range reduction factors due to full thermal cycles are listed in Table 4.3-1.~~

~~3. Environmental fatigue~~ 3. CUF calculations for ~~ASME Code Class 1 reactor coolant pressure boundary~~ components~~.~~

~~Generic Safety Issue: The fatigue design criteria for nuclear power plant components have changed as the industry consensus codes and standards have developed. The fatigue design criteria for a specific component depend on the version of the design code~~ that ~~applied to that component, i.e., the code of record. There is a concern that the effects of the reactor coolant environment on the fatigue life of components were not adequately addressed by the code of record.~~

~~The NRC 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 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 where 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 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~~require evaluation of 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 of pressure boundary components for 60 years of plant operation.~~ effects (CUF_{en}).

~~The scope of GSI-190 included design basis fatigue transients. It studied the probability of fatigue failure and its effect on core damage frequency (CDF) of selected metal components for 60-year plant life. The results showed that some components have cumulative probabilities of crack initiation and through-wall growth that approach one within the 40- to 60-year period. The maximum failure rate (through-wall cracks per year) was in the range of 10E-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. It was concluded that no generic regulatory action is necessary and that GSI-190 is resolved based on results of probabilistic analyses and sensitivity studies, interactions with the industry (NEI and EPRI), and different approaches available to licensees to manage the effects of aging (Refs. 11 and 12).~~

~~However, the calculations supporting resolution of this issue, which included consideration of environmental effects, indicate the potential for an increase in the frequency of pipe leaks as plants continue to operate. Thus, the staff concluded that licensees are to address the effects of coolant environment on component fatigue life as aging management programs are formulated in support of license renewal.~~

~~The applicant's consideration of the effects of coolant environment on component fatigue life for license renewal is an area of review.~~

4. ~~Potential fatigue assessments for BWR vessel internals components (potential TLAAs based on applicable applicant action items identified in applicable BWRVIP reports)~~

~~For Boiling Water Reactors, license renewal applications that reference the following BWR Vessels and Internals Project (BWRVIP) reports should identify and evaluate the projected fatigue CUFs as a potential TLAA issue, which may impact the structural integrity of the subject reactor pressure vessel internal components.~~

- ~~BWRVIP-18-A (Ref. 16, action item #4) for core spray internals~~
- ~~BWRVIP-27-A (Ref. 17, action item #4) for standby liquid control system/core plate ΔP~~
- ~~BWRVIP-47-A (Ref. 18, action item #4) for lower plenum.~~

~~In addition, license renewal applications that reference the BWRVIP-74-A report (Ref. 19) for reactor pressure vessel, should address the following renewal applicant action items in the staff's SER for BWRVIP-74-A report.~~

~~Item #8: For the license renewal period, verify that the original fatigue analysis is valid and also addresses environmental fatigue for components mentioned in NUREG/CR-6260. As a minimum, these components normally include reactor coolant pressure boundary components, such as reactor vessel head and shell components, reactor vessel flange bolting or stud components, reactor vessel nozzle components, and piping components, including safe-end locations.~~

~~Item #14: Components that have indications that were previously analytically evaluated in accordance with ASME Section XI Subsection IWB-3600 until the end of the 40-year service period shall be re-evaluated for the period corresponding to the license renewal term.~~

~~5. Potential~~ Fatigue-based flaw growth~~ analyses~~, flaw tolerance, or ~~fatigue-based~~ fracture mechanics analyses, including those ~~for high-energy line breaks, reactor coolant pump (RCP) flywheels, reactor vessel metal bellows, and reactor vessel underclad cracking analyses (applicable to reactor vessels fabricated from SA-508 Class 2 or 3 forgings), as appropriate~~

~~The validity of these analyses is reviewed for the period of extended operation. The design criteria~~ used to ~~determine the postulated high-energy line break design locations include the calculated fatigue CUF based on the number of design transients assumed for the 40-year life of the plant. The aging effect of concern for the RCP flywheel is fatigue crack initiation and growth in the flywheel bore keyway from stresses due to starting the motor during start/stop cycles of the RCP during the 40-year design. Similarly, the primary containment process metal bellows are designed for a specific number of cycles of expansion and contraction for 40 years of operation. The fracture toughness (including the effects of neutron irradiation) and flaw growth analyses for underclad cracks that are postulated in the internal cladding of SA-508 Class 2 and 3 alloy steel components are also based upon 40-year design transients~~support reinspection intervals for components.

4.3.2 Acceptance Criteria

~~The~~ Acceptance criteria are provided in the following subsections for the areas of review described in Subsection 4.3.1 ~~of this review plan section~~that delineate acceptable methods for meeting the requirements of the ~~NRC's~~U.S. Nuclear Regulatory Commission (NRC) regulations in Title 10 of the *Code of Federal Regulations* (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~~:~~ for each analysis:

i. ~~(i)~~ The analyses remain valid for the period of extended operation;

~~i.~~ii. The analyses have been projected to the end of the period of extended operation~~,~~; or

~~(ii) the analyses have been projected to the end of the extended period of operation, or~~

~~ii.~~iii. ~~(iii)~~ The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In some instances, the applicant may identify activities to be performed to verify the assumption bases of the fatigue analyses. Evaluations of those activities are provided by the applicant. The reviewer assures that the applicant's activities are sufficient to confirm the calculation assumptions for the subsequent period of extended operation.

Specific acceptance criteria for metal component fatigue evaluations are discussed in the following ~~sub-sections~~subsections.

4.3.2.1.1 ~~ASME Code Class 1~~ Components ~~Designed to ASME Section III and other Codes based on CUF~~Evaluated for Fatigue Parameters Other than CUF_{en}

For metal components ~~designed or analyzed to ASME Code Section III requirements for Class I components or other Codes that require a CUF calculation~~evaluated for fatigue parameters other than CUF_{en}, the acceptance criteria~~, depending~~ depend on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), ~~are discussed in the following sub-sections.~~and are as follows:

4.3.2.1.1.1 10 CFR 54.21(c)(1)(i)

The existing ~~CUF~~fatigue parameter calculations remain valid for the subsequent period of extended operation because the number of accumulated cycles ~~for the design basis transients would not~~ and the assumed severity of each of the cyclic loadings evaluated in the calculations are not projected to exceed the limits ~~established~~evaluated for these ~~transients~~loadings. The revised projections are verified to be consistent with historical plant operating characteristics and anticipated future operation.

4.3.2.1.1.2 10 CFR 54.21(c)(1)(ii)

The ~~CUF calculation analyses~~fatigue parameter calculations are ~~projected~~revised and shown to remain acceptable throughout the ~~end of the extended~~ subsequent period of extended operation based on ~~projecting~~ a revised projection of the cumulative number and assumed severity of ~~transient occurrences for design basis transients through~~each of the cyclic loadings to the ~~expiration~~end of the subsequent period of extended operation. The revised projections are verified to be consistent with historical plant operating characteristics and anticipated future operation. The resulting ~~CUF~~fatigue parameter values are verified to remain less than or equal to ~~a CUF~~their respective allowable value ~~of one~~ for the subsequent period of extended operation.

4.3.2.1.1.3 10 CFR 54.21(c)(1)(iii)

~~In Chapter X.M1 of the GALL~~The applicant proposes an aging management program (AMP) as the basis for demonstrating that the effect or effects of aging on the intended function(s) of the structure(s) or component(s) in the fatigue parameter evaluations will be adequately managed during the subsequent period of extended operation. The AMP in Section X.M1, "Cyclic Load Monitoring," of the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) report provides one method that may be used to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii).

An applicant may also propose another AMP to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii). If the basis for aging management is a plant-specific AMP, the AMP is described in terms of the 10 program elements defined in the Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR), Appendix A.1, “Branch Technical Position, Aging Management Review—Generic,” Sections A.1.2.3.1 through A–1.2.3.10.

If an inspection program is proposed as the basis for aging management, the applicant should ensure that: (a) inspections will be performed for the specific component(s) or structure(s) in the evaluation and (b) applicant has justified that the inspection methods and frequencies in the proposed inspection program are applicable to the component(s), such that they may be used to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii).

4.3.2.1.2 Components Evaluated for CUF_{en}

For metal components evaluated for CUF_{en}, the acceptance criteria depend on the applicant’s choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii).

Applicants should also include CUF_{en} calculations for additional component locations if they are considered to be more limiting than those previously evaluated. The sample of critical components can be evaluated by applying environmental correction factors to the existing CUF analyses or by performing more refined calculations. Environmental effects on fatigue for these critical components can be evaluated using the positions described in Regulatory Guide (RG) 1.207, Revision 1 (Ref. 5) or an NRC staff-approved alternative.

4.3.2.1.2.1 10 CFR 54.21(c)(1)(i)

The existing CUF_{en} calculations remain valid for the subsequent period of extended operation because the number of accumulated cycles, the assumed severity of the cyclic loadings, and the assumed water chemistry conditions evaluated in the calculations are not projected to exceed the limits evaluated for these loadings. The revised projections for the number of accumulated cycles are verified to be consistent with historical plant operating characteristics and anticipated future operation.

For stainless steel (SS) and nickel alloy materials, or any location where average temperature was used in the calculation, or where a constant F_{en} value of 1.49 was used for nickel alloy materials, the methods are updated under 10 CFR 54.21(c)(1)(ii) to use the positions described in RG 1.207, Revision 1.

4.3.2.1.2.2 10 CFR 54.21(c)(1)(ii)

The CUF_{en} calculations are revised and shown to remain acceptable throughout the subsequent period of extended operation based on a revised projection of the cumulative number of occurrences, the assumed severity of cyclic loadings, and the assumed water chemistry conditions to the end of the subsequent period of extended operation. The revised projections are verified to be consistent with historical plant operating characteristics and anticipated future operation. The resulting CUF_{en} values are verified to remain less than or equal to unity for the subsequent period of extended operation. The positions described in RG 1.207, Revision 1 are used for all component evaluations as a part of revising the calculations.

4.3.2.1.2.3 10 CFR 54.21(c)(1)(iii)

In Section X.M1 of the GALL-SLR Report~~ (Ref. 13),~~, the NRC staff ~~has~~ evaluated a program for monitoring and tracking the number of occurrences and the severity of critical ~~thermal and pressure transients~~cyclic loadings for ~~the~~ selected components. ~~The~~ In Section XI.M2 of the GALL-SLR Report, the NRC staff ~~has~~evaluated a program for monitoring and tracking water chemistry conditions. The NRC staff determined that ~~this program is an~~these programs, when used together, are acceptable ~~aging management program~~AMPs to address ~~metal~~the effects of reactor water environment on component fatigue ~~of the reactor coolant system components~~life according to 10 CFR 54.21(c)(1)(iii). The GALL-SLR Report may be referenced in ~~a~~an subsequent license renewal application (SLRA) and should be treated in the same manner as an approved topical report. In referencing the GALL-SLR Report, the applicant should indicate that the material referenced is applicable to the specific plant involved and should provide the information necessary to adopt the finding of program acceptability as described and evaluated in the report. The applicant also should verify that the approvals set forth in the GALL-SLR Report for the generic program apply to the applicant's program. Alternatively, the components could be replaced and the CUF_{en} values for the replacement components shown to be acceptable for the subsequent period of extended operation.

~~1.1.7.6.4~~ 4.3.2.~~1.~~2 ~~Piping Components Designed to USAS ANSI B31.1 Requirements and ASME Code Class 2 and 3 Components Designed to ASME Section III Requirements~~

~~For piping designed or analyzed to B31.1 guidance or ASME Code Class 2 and 3 components designed to ASME Section III cyclic design requirements, the acceptance criteria, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), are discussed in the following sub-sections.~~

~~1.1.7.6.4.1 4.3.2.1.2.1 10 CFR 54.21(c)(1)(i)~~

~~The maximum allowable stress range values for the existing fatigue analysis remain valid because the allowable limit for the number of full thermal range transient cycles would not be exceeded during the period of extended operation.~~

~~1.1.7.6.4.2 4.3.2.1.2.2 10 CFR 54.21(c)(1)(ii)~~

~~The maximum allowable stress range values are re-evaluated based on the projected number of assumed full thermal range transient cycles above a value of 7000 (refer to Table 4.3-1). The current stress range value in the design basis for the component is then compared to the reduced maximum allowable stress range value to make sure it is within the value of the newly-reduced limit, and to ensure that the design basis value remains acceptable during the period of extended operation.~~

~~1.1.7.6.4.3 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. Chapter X.M1 in the GALL~~*Final Safety Analysis* Report ~~provides an acceptable method for dispositioning fatigue analyses under 10 CFR 54.21(c)(1)(iii). Alternatively, the component could be replaced and the allowable stresses for the replacement will be sufficient as specified by the code during the period of extended operation. The analyses 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.~~

~~*1.1.7.6.5 4.3.2.1.3 Environmental Fatigue Calculations for Code Class 1 Components*~~

~~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. For reactor coolant pressure boundary components, one method acceptable to the staff for 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 selected in NUREG/CR-6260 (Ref. 10). Applicants should consider adding additional component locations if they are considered to be more limiting than those considered in NUREG/CR-6260. The sample of critical components can be evaluated by applying environmental correction factors to the existing ASME Code fatigue analyses.~~

~~Applicants should consider adding additional component locations if they are considered to be more limiting than those considered in NUREG/CR-6260. The sample of critical components can be evaluated by applying environmental correction factors to the existing ASME Code fatigue analyses. Applicants should add additional plant specific component locations if they may be more limiting than those considered in NUREG/CR-6260. Environmental effects on fatigue for these critical components can be evaluated using one of the following sets of formulae:~~

- ~~Carbon and Low Alloy Steels~~
  - ~~Those provided in NUREG/CR-6583 (Ref. 14), using the applicable ASME Section III fatigue design curve.~~
  - ~~Those provided in Appendix A of NUREG/CR-6909 (Ref. 21), using either the applicable ASME Section III fatigue design curve or the fatigue design curve for carbon and low alloy steel provided in NUREG/CR-6909 (Figures A.1 and A.2, respectively, and Table A.1).~~
  - ~~A staff approved alternative.~~

- ~~Austenitic Stainless Steels~~
  - ~~Those provided in NUREG/CR-5704 (Ref. 15), using the applicable ASME Section III fatigue design curve.~~
  - ~~Those provided in NUREG/CR-6909 (Ref. 21), using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).~~
  - ~~A staff approved alternative.~~

- ~~Nickel Alloys~~
  - ~~Those provided in NUREG/CR-6909 (Ref. 21), using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).~~
  - ~~A staff approved alternative.~~

~~Any one option may be used for calculating the CUF_{en} for each material.~~

~~*1.1.7.6.6 4.3.2.1.4 Potential Fatigue Assessments for BWR Vessel Internals Components*~~

~~The acceptance criteria in Subsection 4.3.2.1.1 of this review plan section apply.~~

~~1.1.7.6.7 4.3.2.1.5 Potential Flaw Growth and Fracture Mechanics Analysis~~

~~Depending on the choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), the acceptance criteria are discussed in the following sub-sections.~~

~~1.1.7.6.7.1 4.3.2.1.5.1 10 CFR 54.21(c)(1)(i)~~

~~The existing analyses remain valid because the number of cycles assumed for the 40-year life would not be exceeded during the period of extended operation.~~

~~1.1.7.6.7.2 4.3.2.1.5.2 10 CFR 54.21(c)(1)(ii)~~

~~The degree of flaw growth or increase in the stress intensity factor are projected based on the cumulative number of transient occurrences to the end of the period of extended operation. The newly-projected values are compared to the acceptance criteria for these parameters that were set in the original analysis.~~

~~1.1.7.6.7.3 4.3.2.1.5.3 10 CFR 54.21(c)(1)(iii)~~

~~The acceptance criteria under 10 CFR 54.21(c)(1)(iii) will be evaluated on a case-by-case basis to ensure that the aging effects will be managed such that the intended functions(s) of the subject components will be maintained during the period of extended operation.~~

~~Chapter X.M1 in the GALL Report may not be used as a basis for accepting fatigue-based flaw growth analyses or fracture mechanics analyses in accordance with 10 CFR 54.21(c)(1)(iii).~~

~~4.3.2.2~~ ~~FSAR~~ *Supplement*

The specific criterion for meeting 10 CFR 54.21(d) is as follows:

The summary description of the evaluation of TLAAs for the subsequent period of extended operation in the Final Safety Analysis Report (FSAR) supplement is appropriate 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 the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

4.3.3 Review Procedures

~~For each area~~Review procedures for metal component fatigue parameter evaluations for the areas of review described in Subsection 4.3.1~~, the review procedures in the subsequent sub-sections should be followed~~ are discussed in the following subsections.

4.3.3.1 Time-Limited Aging Analysis

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 using an appropriate Code reconciliation. In the latter case, the reviewer verifies that the requirements in 10 CFR 50.55a are met.

4.3.3.1.1 ~~ASME Code Class 1~~ *Components* ~~Designed to ASME Section III and~~ *Evaluated for Fatigue Parameters Other* ~~Codes based on CUF~~*Than* CUF_{en}

For metal components ~~designed or analyzed to ASME Class 1 requirements or~~evaluated for fatigue parameters other ~~Codes that are based on a CUF calculation~~than CUF_{en}, the review procedures~~, depending~~ depend on the applicant’s choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), and are ~~discussed in the following sub-sections.~~as follows:

4.3.3.1.1.1 10 CFR 54.21(c)(1)(i)

The operating ~~transient~~cyclic load experience and a list of the assumed transients used in the existing ~~CUF~~fatigue parameter calculations is reviewed for the current operating term ~~are reviewed~~ to ensure that the projected number of ~~assumed transients would not be exceeded~~transient occurrences during the subsequent period of extended operation~~.~~ will not exceed the assumed number of transient occurrences in the existing fatigue parameter calculations. The projected number of occurrences for each transient is verified to be consistent with historical plant operating characteristics and anticipated future operation. In addition, a comparison of the operating cyclic load severity to the severity for each transient assumed in the existing fatigue parameter calculations is made to demonstrate that the cyclic load severity for each transient used in the fatigue parameter calculations remains bounding. For consistency purposes, the review also includes an assessment of the TLAA information against relevant design basis information and current licensing basis (CLB) information~~ (including applicable cycle-counting requirements in technical specifications).~~.

4.3.3.1.1.2 10 CFR 54.21(c)(1)(ii)

The operating ~~transient~~cyclic load experience is reviewed to ensure that the increased number of ~~transients~~cyclic load occurrences and their severity for each transient used for any ~~re-analysis meets or exceeds~~reanalysis remain within the number of ~~transients~~transient occurrences and severity for each transient projected to the end of the subsequent period of extended operation. The revised ~~CUF~~fatigue parameter calculations are reviewed to ensure that the ~~CUF~~fatigue parameter remains less than or equal to ~~one~~ the allowed value at the end of the ~~period of extended operation.~~ subsequent period of extended operation. The revised fatigue parameter calculations are shown to remain acceptable based on revised projections of the cumulative number of occurrences and the assumed severity of each transient to the end of the subsequent period of extended operation. The revised projections are verified to be consistent with historical plant operating characteristics and anticipated future operation. For consistency purposes, the review also includes an assessment of the TLAA information against relevant design basis information and CLB information.

4.3.3.1.1.3 10 CFR 54.21(c)(1)(iii)

Pursuant to 10 CFR 54.21(c)(1)(iii), the applicant proposes an AMP or aging management activities as the basis for demonstrating that the effect or effects of aging on the intended function(s) of the structure(s) or component(s) in the fatigue parameter evaluation will be adequately managed during the subsequent period of extended operation. If Section X.M1, “Cyclic Load Monitoring,” of the GALL-SLR Report is used as the basis for managing cumulative fatigue damage or cracking due to fatigue or cyclical loading in the structure(s) or component(s), the reviewer reviews the applicant’s AMP against the program elements defined in GALL-SLR Report Section X.M1.

An applicant also has the option of proposing another GALL-based AMP, plant-specific AMP, or plant-specific activities, or combination of, to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii). If another GALL-based AMP is proposed as the basis for aging management, the reviewer reviews the applicant’s AMP against the program element criteria defined in the applicable AMP section in Chapter XI of the GALL-SLR Report. If the basis for aging management is a plant-specific AMP or plant-specific aging management activities, the reviewer reviews the program element criteria for the AMP or activities against the program element criteria defined in this SRP-SLR, Appendix A.1, “Branch Technical Position, Aging Management Review—Generic,” Sections A.1.2.3.1 through A.1.2.3.10.

If a sampling based inspection program (a type of condition monitoring program) is proposed as the basis for aging management, the reviewer ensures that the AMP actually performs inspections of the specific component(s) or structure(s) in the evaluation at each unit in a multiunit site and that the applicant has appropriately justified that the inspection methods and associated frequencies are capable of managing cumulative fatigue damage or cracking by fatigue or cyclical loading in the component(s) or structure(s), such that the TLAA may be accepted in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.3.1.2 Components Evaluated for CUF_{en}

For metal components evaluated for CUF_{en}, the review procedures depend on the applicant’s choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii).

Applicants should include CUF_{en} calculations for the limiting component locations exposed to the reactor water environment. A sample of critical components can be evaluated by applying environmental correction factors to the existing CUF analyses or by performing more refined calculations. Environmental effects on fatigue for these critical components can be evaluated using the positions described in RG 1.207, Revision 1, or a NRC staff-approved alternative.

4.3.3.1.2.1 10 CFR 54.21(c)(1)(i)

The operating cyclic load experience and a list of the assumed transients used in the existing fatigue parameter calculations are reviewed for the current operating term to ensure that the number of assumed occurrences of each transient would not be exceeded during the subsequent period of extended operation. A comparison of the operating cyclic load severity to the severity assumed in the existing fatigue parameter calculations for each transient should be made to demonstrate that the cyclic load severities used in the fatigue parameter calculations remain bounding. In addition, a comparison of the water chemistry conditions to those assumed in the existing environmental multiplier (F_{en}) calculations should be made to demonstrate that the water chemistry conditions used in the F_{en} calculations remain appropriate. For consistency purposes, the review also includes an assessment of the TLAA information against relevant design basis information and CLB information ~~(including applicable cycle-counting requirements in technical specifications~~. For SS and nickel alloy materials, or any location where average temperature was used in the calculation, or where a constant F_{en} value of 1.49 was used for nickel alloy materials, the review includes verification that the methods have been updated to use the positions described in RG 1.207, Revision 1 under the provisions of 10 CFR 54.21(c)(1)(ii).

4.3.3.1.2.2 10 CFR 54.21(c)(1)(ii)

The operating cyclic load experience and a list of the assumed transients used in the existing fatigue parameter calculations is reviewed for the current operating term to ensure that the number of assumed occurrences for each transient are projected to the end of the subsequent period of extended operation. The reviewer verifies that a comparison of the operating cyclic load severity to the severity assumed in the existing fatigue parameter calculations for each transient has been made to demonstrate that the cyclic load severities used in the fatigue parameter calculations remain bounding. In addition, the reviewer verifies that a comparison of the water chemistry conditions to those assumed in the F_{en} calculations has been made to demonstrate that the water chemistry conditions used in the F_{en} calculations are appropriate. For consistency purposes, the review also includes an assessment of the TLAA information against relevant design basis information and CLB information. The review includes verification that the positions described in RG 1.207, Revision 1 are used for all component evaluations as a part of revising the calculations.

The Code of Record should be used for the reevaluation, or the applicant may update to a later Code edition pursuant to 10 CFR 50.55a~~.~~ using an appropriate Code reconciliation. In the latter case, the reviewer verifies that the requirements in 10 CFR 50.55a are met.

4.3.3.1.~~1~~2.3 10 CFR 54.21(c)(1)(iii)

The applicant may reference ~~Chapter~~Sections X.M1 and XI.M2 of the GALL-SLR Report in its ~~license renewal~~SLR application and use ~~this~~these GALL~~-chapter~~-SLR chapters to accept the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), as appropriate. The review should verify that the applicant has stated that the report is applicable to its plant with respect to its program that monitors and tracks the number and severity of critical ~~thermal and pressure transients~~cyclic loadings and water chemistry conditions for ~~the selected reactor coolant system~~metal components. The reviewer verifies that the applicant has identified the appropriate ~~program~~programs as described and evaluated in the GALL-SLR Report. The reviewer also ensures that the applicant has stated that its program contains the same program elements that the NRC staff evaluated and relied upon in approving the corresponding generic program in the GALL-SLR Report. For consistency purposes, the review also includes an assessment of the TLAA information against ~~relevant design basis and CLB information (including applicable cycle-counting requirements in technical specifications). No staff re-evaluation of the acceptability of the basis in the GALL Report Chapter X.M1 is necessary.~~

~~*1.1.7.6.8 4.3.3.1.2 Piping Components Designed to USAS ANSI B31.1 Requirements and ASME Code Class 2 and 3 Components Designed to ASME Section III Requirements*~~

~~For piping designed or analyzed to ANSI B31.1 guidance or ASME Code Class 2 and 3 components designed to ASME Section III cyclic design requirements, the review procedures, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), are discussed in the following sub-sections.~~

~~*1.1.7.6.8.1 4.3.3.1.2.1 10 CFR 54.21(c)(1)(i)*~~

~~The staff reviews the relevant information in the TLAA, operating plant transient history, design basis, and CLB (including technical specification cycle counting requirements) to verify that the maximum allowable stress range values for the existing fatigue analysis remain valid for the period of extended operation and that the allowable limit for full thermal range transients will not be exceeded during the period of extended operation.~~

~~*1.1.7.6.8.2 4.3.3.1.2.2 10 CFR 54.21(c)(1)(ii)*~~

~~The maximum allowable stress range values are re-evaluated based on the projected number of full thermal range transient cycles above a value of 7000 (refer to Table 4.3-1). The reviewer confirms that (1) if the value of the number of equivalent full temperature cycles is above 7000, the applicant has reduced the maximum allowable stress range limit according to the reduction factors in the table, and (2) the design basis stress value for the component is within the newly-reduced allowable limit. The review includes all~~ relevant design basis~~, operating history, CLB,~~ and ~~TLAA~~CLB information~~,~~ (including ~~technical specification~~applicable cycle-counting requirements~~.~~ and water chemistry monitoring set forth in the applicable AMPs).

~~*1.1.7.6.8.3 4.3.3.1.2.3 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. Chapter X.M1 in the GALL Report provides an acceptable method to disposition these fatigue analyses under 10 CFR 54.21(c)(1)(iii). The staff reviews an applicant's program for dispositioning the TLAA in accordance with the requirements in 10 CFR 54.21(c)(1)(iii) and the guidance in GALL Chapter X.M1.~~

~~In addition to continued monitoring and tracking, the components could be re-analyzed, inspected for cracking, repaired, or replaced. Such approaches 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.~~

~~*1.1.7.7 4.3.3.1.3 Other Evaluations Based on CUF*~~

~~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 a sample of high-fatigue usage locations. This sample is to include the locations identified in NUREG/CR-6260 (Ref. 10), as a minimum, and proposed additional locations based on plant specific considerations.~~

2. ~~The sample of critical components has been evaluated (1) by applying environmental correction factors to the existing ASME Code required CUF analyses, or (2) using the methodology provided in NUREG/CR-6909 (Ref. 21). If the Class 1 component was designed to a code not requiring CUF, a new environmental CUF calculation has been performed or is addressed in an appropriate license renewal commitment.~~

3. ~~Environmental effects on fatigue for these critical components have been evaluated using one of the following sets of formulae:~~

    - ~~Carbon and Low Alloy Steels~~
        - ~~Those provided in NUREG/CR-6583 (Ref. 14), using the applicable ASME Section III fatigue design curve.~~
        - ~~Those provided in Appendix A of NUREG/CR-6909 (Ref. 21), using either the applicable ASME Section III fatigue design curve or the fatigue design curve for~~

~~carbon and low alloy steel provided in NUREG/CR-6909 (Figures A.1 and A.2, respectively, and Table A.1).~~

- ~~A staff approved alternative.~~

- ~~Austenitic Stainless Steels~~
  - ~~Those provided in NUREG/CR-5704 (Ref. 15), using the applicable ASME Section III fatigue design curve.~~
  - ~~Those provided in NUREG/CR-6909 (Ref. 21), using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).~~
  - ~~A staff approved alternative.~~

- ~~Nickel Alloys~~
  - ~~Those provided in NUREG/CR-6909 (Ref. 21), using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).~~
  - ~~A staff approved alternative.~~

~~Any one option may be used for calculating the~~ $\cancel{CUF_{en}}$ ~~for each material.~~

~~*1.1.7.7.1 4.3.3.1.4 Potential Fatigue Assessments for BWR Vessel Internals Components*~~

~~The review procedures in Subsection 4.3.3.1.1 of this review plan section apply.~~

~~*1.1.7.7.2 4.3.3.1.5 Potential Flaw Growth and Fracture Mechanics Analysis*~~

~~Depending on the choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), the review procedures are discussed in the following sub-sections.~~

~~*1.1.7.7.2.1 4.3.3.1.5.1 10 CFR 54.21(c)(1)(i)*~~

~~The operating cyclic experience and a list of the assumed cycles used in the existing analyses are reviewed to ensure that the number of assumed cycles would not be exceeded during the period of extended operation.~~

~~*1.1.7.7.2.2 4.3.3.1.5.2 10 CFR 54.21(c)(1)(ii)*~~

~~The staff reviews the applicant's basis for projecting the amount of flaw growth or increase in the stress intensity factor value to the end of the period of extended operation. The staff ensures that the applicant's basis is valid and that the newly-projected values are compared to the acceptance criteria for these parameters that were set in the original analysis.~~

~~*1.1.7.7.2.3 4.3.3.1.5.3 10 CFR 54.21(c)(1)(iii)*~~

~~The staff reviews the applicant's proposed program to ensure that the effects of aging on the intended function(s) of the subject component will be adequately managed for the period of extended operation. The acceptance criteria under 10 CFR 54.21(c)(1)(iii) will be evaluated on a case-by-case basis. Chapter X.M1 in the GALL Report may not be used as a basis for~~

~~accepting fatigue-based flaw growth analyses or fracture mechanics analyses in accordance with 10 CFR 54.21(c)(1)(iii).~~

~~4.3.3.2 FSAR~~ An applicant also has the option of proposing another GALL-based AMP, plant-specific AMP, or plant-specific activities, or combination of, to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii). If another GALL-based AMP is proposed as the basis for aging management, the reviewer reviews the applicant's AMP against the program element criteria defined in the applicable AMP section in Chapter XI of the GALL-SLR Report. If the basis for aging management is a plant-specific AMP or plant-specific aging management activities, the reviewer reviews the program element criteria for the AMP or activities against the program element criteria defined in this SRP-SLR, Appendix A.1, "Branch Technical Position, Aging Management Review—Generic," Sections A.1.2.3.1 through A.1.2.3.10.

If a sampling based inspection program (a type of condition monitoring program) is proposed as the basis for aging management, the reviewer ensures that the AMP actually performs inspections of the specific component(s) or structure(s) in the evaluation at each unit in a multiunit site and that the applicant has appropriately justified that the inspection methods and associated frequencies are capable of managing cumulative fatigue damage or cracking by fatigue or cyclical loading in the component(s) or structure(s), such that the TLAA may be accepted in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.3.2 Final Safety Analysis Report Supplement

The reviewer verifies that the applicant has provided information to be included in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA. Table 4.3-~~2~~1 contains examples of acceptable FSAR supplement information for ~~this TLAA.~~metal fatigue TLAAs that are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii). The reviewer verifies that the applicant has provided a FSAR supplement with information equivalent to that in Table 4.3-~~2.~~1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.

As noted in Table 4.3-~~2~~1, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities, including enhancements and commitments to be completed before the start of the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

4.3.4 Evaluation Findings

The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of this section and whether the NRC 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 NRC staff's Safety Evaluation Report:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the [reviewer to insert applicable type of metal fatigue analysis] TLAA, [choose which is appropriate] (i) the analyses remain valid for the subsequent period of extended operation, (ii) the analyses have been projected to the end of the subsequent period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the subsequent period of extended operation. The NRC staff also concludes that the FSAR Supplement contains an appropriate summary description of the [reviewer to insert applicable type of metal fatigue analysis] TLAA, evaluation for the subsequent period of extended operation as reflected in the license condition.

4.3.5 Implementation

Except in those cases ~~in which~~where the applicant proposes an acceptable alternative~~ method~~, the ~~method~~methods described herein will be used by the NRC staff in its ~~evaluation~~evaluations of conformance with NRC regulations.

4.3.6 References

1. ASME~~ Section III,~~. "Rules for Construction of Nuclear Power Plant Components~~," The~~." ASME Boiler and Pressure Vessel Code, ~~2004 edition, The~~Section III. New York City, New York: American Society of Mechanical Engineers~~, New York, NY.~~.

2. ANSI/ASME B31.1, "Power Piping~~,"~~." New York City, New York: American National Standards Institute.

3. ANSI/ASME B31.7-1969, "Nuclear Power Piping~~,"~~." New York City, New York: American National Standards Institute.

~~1. SECY-93-049, "Implementation of 10 CFR Part 54, 'Requirements for Renewal of Operating Licenses for Nuclear Power Plants,'" March 1, 1993.~~

~~2. Staff Requirements Memorandum from Samuel J. Chilk, dated June 28, 1993.~~

~~3. NUREG-0933, "Resolution of Generic Safety Issues," Supplement 32, U.S. Nuclear Regulatory Commission, August 2008.~~

~~4. Letter from William T. Russell of NRC to William Rasin of the Nuclear Management and Resources Council, dated July 30, 1993.~~

~~5. SECY-94-191, "Fatigue Design of Metal Components," July 26, 1994.~~

~~6. SECY-95-245, "Completion of the Fatigue Action Plan," September 25, 1995.~~

~~7. NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," March 1995.~~

~~8. Letter from Ashok C. Thadani of the Office of Nuclear Regulatory Research to William D. Travers, Executive Director of Operations, dated December 26, 1999.~~

~~9. NUREG/CR-6674, "Fatigue Analysis of Components for 60-Year Plant Life," June 2000.~~

~~10. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

~~11. NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low–Alloy Steels," March 1998.~~

~~12. NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," April 1999.~~

~~13. NRC Acceptance for Referencing of BWR Vessel and Internals Project, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines for Compliance with the License Renewal Rule (10CFR Part 54), Dec. 7, 2000, in BWRVIP-18-A, "BWR Vessel and Internals Project BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines," EPRI TR-1011469, February 2005.~~

~~14. NRC Acceptance for Referencing of Report, "BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines," for Compliance with the License Renewal Rule (10CFR Part 54), Dec. 20, 1999, in BWRVIP-27-A, "BWR Vessel and Internals Project BWR Standby Liquid Control System/Core Plate □P Inspection and Flaw Evaluation Guidelines," EPRI TR-1007279, August 2003.~~

~~15. NRC Acceptance for Referencing of Report, "BWR Vessel and Internals Project, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines," for Compliance with the License Renewal Rule (10CFR Part 54), Dec. 7, 2000, in BWRVIP-47-A, "BWR Vessel and Internals Project BWR Lower Plenum Inspection and Flaw Evaluation Guidelines," EPRI TR-1009947, June 2004.~~

~~16. NRC Acceptance for Referencing of EPRI Proprietary Report TR-113596, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," and Appendix A, "Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10CFR 54.21)," Oct. 18, 2001, in BWRVIP-74-A, "BWR Vessel and Internals Project BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," EPRI TR-1008872, June 2003.~~

~~Regulatory~~ 4. NRC. Regulatory Guide ~~RG-~~1.207, "Guidelines for Evaluating ~~Fatigue Analyses Incorporating the Life Reduction of Metal Components due to~~ the Effects of ~~the~~ Light-Water Reactor ~~Environment for New Reactors," U.S. Nuclear Regulatory Commission,~~Coolant Environments in Fatigue Analyses of Metal Components." Revision 1. Washington, DC~~, March 2007.~~: U.S. Nuclear Regulatory Commission. 2014.

5. NRC. NUREG/CR-6909, Revision 1, ANL-12/60, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials~~" (Final Report), February 2007.~~." ML14087A068. Washington, DC: U.S. Nuclear Regulatory Commission. March 2014.

6. ASME. Section III, “Rules for Construction of Nuclear Facility Components.” New York City, New York: American Society of Mechanical Engineers.

7. ASME. Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components, Nonmandatory, Appendix A, Analysis of Flaws.” New York City, New York: American Society of Mechanical Engineers.

8. ASME. Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components, Appendix C, Evaluation of Flaws in Austenitic Piping.” New York City, New York: American Society of Mechanical Engineers.

Table 4.3-1 ~~Stress Range Reduction Factors~~. Examples of FSAR Supplement for Metal Fatigue TLAA Evaluation

10 CFR 54.21(c)(1)(i) Examples		
TLAA	**Description of Evaluation**	**Implementation Schedule***
Components Evaluated for Fatigue Parameters Other than CUF_{en}	~~**Number of Equivalent Full Temperature Cycles**~~[Applicant to identify and provide adequate description of the specific metal fatigue parameter evaluation] The number of occurrences and severity of each of the thermal and pressure transients, projected to the end of the subsequent license renewal operating period, demonstrate that the [Applicant to insert Name of the TLAA] remains valid during the subsequent license renewal operating period and therefore, that this TLAA is acceptable in accordance with the criterion in 10 CFR 54.21(c)(1)(i).	~~**Stress Range Reduction Factor**~~Completed (prior to submittal of an application for SLR)
Components Evaluated for CUF_{en}	~~7,000 and less~~[Applicant to identify and provide adequate description of the specific metal fatigue evaluation for evaluating environmentally assisted fatigue in ASME Code Class 1 or Safety Class 1 components] The effects of the water environment on component fatigue life have been addressed by assessing the impact of the water environment on the limiting component locations, using the positions described in Regulatory Guide 1.207, Revision 1. The number of occurrences and severity of each of the thermal and pressure transients, projected to the end of the subsequent license renewal operating period, and consideration of the water chemistry parameters demonstrate that the TLAA on environmentally assisted fatigue remains valid during the subsequent license renewal operating period and therefore, that this TLAA is acceptable in accordance with 10 CFR 54.21(c)(1)(i).	~~1.0~~Completed (prior to submittal of an application for SLR)
10 CFR 54.21(c)(1)(ii) Examples		
TLAA	**Description of Evaluation**	**Implementation Schedule***
Components Evaluated for Fatigue Parameters Other than CUF_{en}	~~7,000 to 14,000~~[Applicant to identify and provide adequate description of the specific metal fatigue parameter evaluation] The analysis has been projected to the end of the subsequent license renewal operating period, considering the number of occurrences and severity of each of the thermal and pressure transients, and demonstrates that the TLAA is acceptable in accordance with 10 CFR 54.21(c)(1)(ii).	~~0.9~~Completed (prior to submittal of an application for SLR)

Table 4.3-1~~ Stress Range Reduction Factors~~. Examples of FSAR Supplement for Metal Fatigue TLAA Evaluation

10 CFR 54.21(c)(1)(i) Examples		
TLAA	**Description of Evaluation**	**Implementation Schedule***
Components Evaluated for CUF_{en}	~~14,000 to 22,000~~Applicant to identify and provide adequate description of the specific metal fatigue evaluation for evaluating environmentally assisted fatigue in ASME Code Class 1 or Safety Class 1 components] The effects of the water environment on component fatigue life have been addressed by assessing the impact of the water environment on the limiting component locations, using the positions described in Regulatory Guide 1.207, Revision 1. The analysis for environmentally-assisted fatigue has been projected to the end of the subsequent license renewal operating period, considering the number of occurrences and severity of each of the thermal and pressure transients and the water chemistry parameters, and demonstrates that the TLAA is acceptable in accordance with 10 CFR 54.21(c)(1)(ii).	~~0.8~~Completed (prior to submittal of an application for SLR)
10 CFR 54.21(c)(1)(iii) Examples		
TLAA	**Description of Evaluation**	**Implementation Schedule***
Components Evaluated for Fatigue Parameters Other than CUF_{en}	~~22,000 to 45,000~~Fatigue evaluations were performed to ensure the continued validity of the metal fatigue analyses for the subsequent license renewal operating period. [Applicant to provide adequate description of the specific metal fatigue parameter evaluation] The AMP monitors and tracks the number of occurrences and severity of thermal and pressure transients, and requires corrective actions to ensure that applicable fatigue analyses remain within their allowable limits. The effects of aging due to fatigue will be managed by the AMP for the subsequent license renewal operating period in accordance with 10 CFR 54.21(c)(1)(iii).	~~0.7~~Program should be implemented before the subsequent period of extended operation
Components Evaluated for CUF_{en}	~~45,000 to 100,000~~The effects of the water environment on component fatigue life will be addressed by assessing the impact of the water environment on the limiting component locations, using the positions described in Regulatory Guide 1.207, Revision 1. A limiting sample of critical components can be evaluated by applying environmental adjustment factors to the existing CUF analyses or by performing more refined calculations. The AMPs monitor and track the number of occurrences and severity of thermal and pressure transients, monitor water chemistry, and require corrective actions to ensure that	~~0.6~~Program should be implemented before the subsequent period of extended operation

Table 4.3-1~~Stress Range Reduction Factors~~**. Examples of FSAR Supplement for Metal Fatigue TLAA Evaluation**

10 CFR 54.21(c)(1)(i) Examples		
TLAA	**Description of Evaluation**	**Implementation Schedule***
	the applicable fatigue analyses remain within their allowable limits. The effects of aging due to environmentally assisted fatigue will be managed by the AMPs for the subsequent license renewal operating period in accordance with 10 CFR 54.21(c)(1)(iii).	
~~100,000 and over~~		~~0.5~~

~~Table 4.3-2 Example of FSAR Supplement for Metal Fatigue TLAA Evaluation~~		
~~10 CFR 54.21(c)(1)(iii) Example~~		
~~TLAA~~	**~~Description of Evaluation~~**	**~~Implementation Schedule*~~**

~~Metal fatigue~~	~~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 addresses 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. Environmental effects on fatigue for these critical components can be evaluated using one of the following sets of formulae:~~
	• ~~Carbon and Low Alloy Steels~~
	  ○ ~~Those provided in NUREG/CR-6583 (Ref. 14), using the applicable ASME Section III fatigue design curve.~~
	  ○ ~~Those provided in Appendix A of NUREG/CR-6909 (Ref. 21), using either the applicable ASME Section III fatigue design curve or the fatigue design curve for carbon and low alloy steel provided in NUREG/CR-6909 (Figures A.1 and A.2, respectively, and Table A.1).~~
	  ○ ~~A staff approved alternative.~~
	
	• ~~Austenitic Stainless Steels~~
	  ○ ~~Those provided in NUREG/CR-5704 (Ref. 15), using the applicable ASME Section III fatigue design curve.~~
	  ○ ~~Those provided in NUREG/CR-6909 (Ref. 21), using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).~~
	  ○ ~~A staff approved alternative.~~
	
	• ~~Nickel Alloys~~
	  ○ ~~Those provided in NUREG/CR-6909 (Ref. 21), using the fatigue design curve for austenitic stainless steel provided in NUREG/CR-6909 (Figure A.3 and Table A.2).~~
	  ○ ~~A staff approved alternative.~~
	~~Any one option may be used for calculating the~~ $\cancel{CUF_{en}}$ ~~for each material.~~
		~~Evaluation should be completed before the period of extended operation~~

~~* An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the period of extended operation. The staff~~		

~~Table 4.3-2 Example of FSAR Supplement for Metal Fatigue TLAA Evaluation~~		
~~10 CFR 54.21(c)(1)(iii) Example~~		
~~TLAA~~	~~Description of Evaluation~~	~~Implementation Schedule*~~
~~expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the commitment date.~~		

4.4 Environmental Qualification (EQ) of Electric Equipment

Review Responsibilities

Primary~~ - ~~—Branch responsible for electrical engineering

Secondary~~ - ~~—None

4.4.1 Areas of Review

~~The~~ The U.S. Nuclear Regulatory Commission (NRC) has established environmental qualification requirements in the Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. Section 50.49 specifically requires each nuclear power plant licensee to establish a program to qualify certain electric equipment (not including equipment located in mild environments) so that such equipment, ~~in~~up to its end-of-life condition, will meet its performance specifications during and following design basis accidents under the most severe environmental conditions postulated at the equipment's respective location ~~after such an accident.~~(qualified life). Such conditions include, among others, conditions resulting from a design basis event such as a loss of coolant ~~accidents (LOCAs~~accident (LOCA), high-energy line ~~breaks~~break (HELBs), and post-LOCA ~~radiation. Equipment~~environments. Electric equipment is qualified ~~by test must be preconditioned by aging~~ to perform its ~~end-of-life condition (i.e.,~~ safety function in those harsh environments after the ~~condition at~~effects of inservice aging. 10 CFR 50.49 requires that the ~~end~~effects of ~~the current operating term).~~significant aging mechanisms be addressed as part of environmental qualification. Those components with a qualified life equal to or greater than the duration of the current operating term are covered by time-limited aging analyses (TLAAs~~.~~).

~~In a related subject,~~ For equipment located in a harsh environment, the objective of Environmental Qualification (EQ) is to demonstrate with reasonable assurance that electric equipment important to safety, for which a qualified life has been established, can perform its safety function(s) without experiencing common cause failures before, during or after applicable design basis events.

For equipment located in a mild environment (an environment that at no time would be significantly more severe than the environment occurring during normal operation, including anticipated operational occurrences—10 CFR 50.49), the demonstration that the equipment can meet its functional requirements during normal environmental conditions and anticipated operational occurrences in accordance with the plant's design and licensing bases. Equipment important to safety located in a mild environment is not part of an EQ program according to 10 CFR 50.49 [10 CFR 50.49(c)]. Documents that demonstrate that a component is qualified or designed for a mild environment include design/purchase specifications, seismic qualification reports, an evaluation or certificate of conformance as applicable.

Some nuclear power plants have mechanical equipment that was qualified in accordance with the provisions of Criterion 4 of Appendix A to 10 CFR Part 50. If a plant has qualified mechanical equipment, it is typically documented in the plant's master EQ list. If this qualified mechanical equipment requires a performance of a TLAA, it should be performed in accordance with the provisions of SRP-~~LR~~SLR Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses." If a TLAA of qualified mechanical equipment is necessary, usually it will involve assessments of the environmental effects on consumable components such as seals, gaskets, lubricants, fluids for hydraulic systems, or diaphragms.

4.4.1.1 Time-Limited Aging Analysis

All operating plants must meet the requirements of 10 CFR 50.49 for certain important-to-safety electrical components. 10 CFR 50.49 defines the scope of components to be included, requires the preparation and maintenance of a list of in-scope components, and requires the preparation and maintenance of a qualification file that includes component performance specifications, electrical characteristics, and environmental conditions. 10 CFR 50.49(e)(5) contains provisions for aging that require, in part, consideration of all significant types of aging degradation that can affect component functional capability. 10 CFR 50.49(e) also requires component replacement or refurbishment prior to the end of designated life, unless additional life is established through reanalysis or ongoing qualification. 10 CFR 50.49(f) establishes four methods of demonstrating qualification for aging and accident conditions. 10 CFR 50.49(k) and (~~l)~~ i) permit different qualification criteria to apply based on plant and component vintage. Supplemental environmental qualification regulatory guidance for compliance with these different qualification criteria is provided in NRC Regulatory Guide (RG) 1.89, Rev. 1, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants" (Ref. 1), and the Division of Operating Reactors (DOR) Guidelines (Ref. 2), and NUREG~~-~~-0588 (Ref. 3). The principal nuclear industry qualification standards for electric equipment are Institute of Electrical and Electronics Engineers (IEEE) STD 323-1971 (Ref. 4) and IEEE STD 323-1974 (Ref. 5). These standards contain explicit ~~environmental qualification~~EQ considerations based on TLAAs. Compliance with 10 CFR 50.49 provides reasonable assurance that the component can perform its intended functions during and following accident conditions after experiencing the effects of inservice aging for applicable equipment.

4.4.1.1.1 ~~DOR~~Division of Operating Reactors Guidelines

The qualification of electric equipment that is subject to significant known degradation due to aging where a qualified life was previously required to be established in accordance with Section 5.2.4 of the DOR Guidelines is reviewed for the period of subsequent period of extended operation according to those requirements. If a qualified life was not previously established, the qualification is reviewed in accordance with Section 7 of the DOR Guidelines.

4.4.1.1.2 NUREG~~-~~-0588, Category II (IEEE STD 323-1971)

The qualification of certain electric equipment important to safety for which qualification was required in accordance with NUREG~~-~~-0588, Category II, is reviewed for conformance to those requirements for the subsequent period of extended operation to assess the validity of the extended qualification. These requirements include IEEE STD 382-1972 (Ref. 6) for valve operators and IEEE STD 334-1971 (Ref. 7). In addition, 10 CFR 50.49(L) has to be addressed for replacement equipment.

4.4.1.1.3 NUREG~~-~~-0588, Category I (IEEE STD 323-1974)

The qualification of certain electric equipment important to safety for which qualification was required in accordance with NUREG~~-~~-0588, Category I, is reviewed for conformance to those requirements for the subsequent period of extended operation to assess the validity of the extended qualification.

4.4.1.2 Generic Safety Issue

Regulatory Issue Summary (RIS) 2003-09 was issued on May 2, 2003, (Ref. 8) to inform addressees of the results of the technical assessment of generic safety issue (GSI~~-~~)-168, ~~""~~“Environmental Qualification of Electrical Equipment~~"~~” (Ref. 9). This RIS requires no action on the part of the addressees.

4.4.1.3 ~~FSAR~~Final Safety Analysis Report Supplement

The detailed information on the evaluation of TLAAs is contained in the subsequent license renewal application~~.~~ (SLRA). A summary description of the evaluation of TLAAs for the period of extended operation is contained in the applicant’s ~~FSAR~~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 delineate acceptable methods for meeting the requirements of the NRC’s regulations in 10 CFR 54.21(c)(1).

4.4.2.1 Time-Limited Aging Analysis

For long-term operation, TLAAs are reviewed to determine continued acceptability of the analyzed component for the subsequent period of extended operation. The time-dependent parameter is reevaluated, analyzed or assumed to determine a value that applies to the subsequent period of extended operation. This new value of the time-dependent parameter is then used to reevaluate the analysis parameter, applicable to the subsequent period of extended operation.

Pursuant to 10 CFR 54.21(c)(1)(i~~) - ()~~–(iii), ~~an applicant must demonstrate~~the TLAA is acceptable if it meets one of the following cases:

(i) The ~~analyses remain~~analysis remains valid for the subsequent period of extended operation~~,~~. The time-dependent parameter(s) for the subsequent period of extended operation does not exceed the time-dependent parameter value used in the existing EQ analysis.

(ii) The ~~analyses have~~analysis has been projected to the end of the ~~extended~~subsequent period of extended operation~~, or~~ and remains acceptable for the subsequent period of extended operation. The time-dependent parameter(s) is projected for the subsequent period of extended operation. The value of the time-dependent analysis parameter(s) remains bounded to the value used in the existing EQ analysis.

(iii) The effects of aging on the intended function(s) will be adequately managed for the subsequent period of extended operation.

The applicant manages the time-dependent parameter [using an aging management program (AMP) (e.g., GALL-SLR Report AMP X.E1, “SLR AMP X.E1 Environmental Qualification (EQ]” of Electric Components) to assure that the value of the analysis parameter continues to meet the EQ analysis value.

Specific acceptance criteria for ~~environmental qualification~~EQ of certain electric equipment important to safety analyzed to Section 5.2.4 of the DOR Guidelines; NUREG~~-~~–0588, Category II (Section 4); or NUREG~~-~~–0588, Category I, depend on the applicant's choice, that is, 10 CFR 54.21(c)(1)(i), (ii), or (iii), and are:

4.4.2.1.1 10 CFR 54.21(c)(1)(i)

The existing qualification is based on previous testing, analysis, or operating experience, or combinations thereof, that demonstrate that the equipment is qualified for the period of extended operation. For option (i), the aging evaluation existing at the time of the ~~renewal application~~SLRA for the component remains valid for the subsequent period of extended operation, and no further evaluation is necessary.

4.4.2.1.2 10 CFR 54.21(c)(1)(ii)

Qualification of the equipment is extended for the subsequent period of extended operation by testing, analysis, or operating experience, or combinations thereof, in accordance with the ~~current licensing basis.~~CLB. For option (ii), a reanalysis of the aging evaluation is performed in order to project the qualification of the component through the subsequent period of extended operation. Important reanalysis attributes of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions if acceptance criteria are not met. These reanalysis attributes are discussed in Table 4.4-1.

4.4.2.1.3 10 CFR 54.21(c)(1)(iii)

In Chapter X of the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report (Ref. 10), the NRC staff has evaluated the ~~environmental qualification~~EQ program (10 CFR 50.49) and determined that it is an acceptable ~~aging management program~~AMP to address ~~environmental qualification~~EQ according to 10 CFR 54.21(c)(1)(iii). The GALL-SLR Report may be referenced in a ~~license renewal application~~SLRA and should be treated in the same manner as an approved topical report. However, the GALL-SLR Report contains one acceptable way and is not the only way to manage aging for ~~license renewal.~~ SLR.

In referencing the GALL-SLR Report, the applicant should indicate that the material referenced is applicable to the specific plant involved and should provide the information necessary to adopt the finding of program acceptability as described and evaluated in the report. The applicant should also verify that the approvals set forth in the GALL-SLR Report for the generic program apply to the applicant's program.

4.4.2.2 ~~FSAR~~Final Safety Analysis Report 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 is appropriate 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 the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

4.4.3 Review Procedures

For each area of review described in Subsection 4.4.1, the following review procedures should be 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~~ depend on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), which are:

4.4.3.1.1 10 CFR 54.21(c)(1)(i)

The documented results, test data, analyses, etc. of the previous qualification, which consisted of an appropriate combination of testing, analysis, and operating experience, are reviewed to confirm that the original qualified life remains valid for the subsequent period of extended operation.

4.4.3.1.2 10 CFR 54.21(c)(1)(ii)

The results of projecting the qualification to the end of the subsequent period of extended operation are reviewed. The qualification methods include testing, ~~analysis~~inspection, operating experience, reanalysis, ongoing qualification or combinations thereof.

The reanalysis of an aging evaluation is normally performed to extend the qualification by ~~reducing~~reevaluating original attributes, assumptions and conservatisms for environmental conditions and other factors to identify excess conservatisms incorporated in the prior evaluation. ~~Such a reanalysis~~ Reanalysis of an aging evaluation to extend the qualification of electrical equipment is performed ~~on a routine basis~~pursuant to 10 CFR 50.49(e) as part of an ~~environmental qualification~~ EQ program. ~~A component~~ While an electrical equipment life ~~-~~ limiting condition may be due to thermal, radiation, or ~~cyclical~~operational/testing and cyclic aging~~;~~, the ~~vast~~ majority of ~~component~~electrical equipment aging limits are based on thermal conditions. ~~Conservatisms~~ Conservatism may exist in aging evaluation parameters, such as the assumed ~~ambient~~service conditions including temperature ~~of the component, unrealistically low activation energy, or in the~~ and radiation, loading, power, signal conditions, cycles, and application ~~of a component (~~(e.g., de-energized versus energized~~).~~), or the use of an unrealistically low activation energy.

The reanalysis of an aging evaluation is ~~documented in accordance with~~performed according to the ~~plant's~~station's quality assurance (QA) program requirements, which ~~provides for~~requires the verification of assumptions and conclusions~~.~~ including the maintenance of required margins and uncertainties.

For reanalysis, the reviewer verifies that an applicant has completed its reanalysis, addressing attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions if acceptance criteria are not met (see Table 4.4-1). The reviewer also verifies that the reanalysis has been completed in a timely manner prior to the end of qualified life.

4.4.3.1.3 10 CFR 54.21(c)(1)(iii)

The applicant may reference the GALL-SLR Report in its ~~license renewal application~~SLRA, as appropriate. The review should verify that the applicant has stated that the report is applicable to its plant with respect to its ~~environmental qualification~~EQ program. The reviewer verifies that the applicant has identified the appropriate ~~program~~AMP as described and evaluated in the GALL-SLR Report. The reviewer also ensures that the applicant has stated that its ~~environmental qualification~~EQ program contains, and is consistent with, the same program elements that the NRC staff evaluated and relied upon in approving the corresponding generic ~~program~~AMP in the GALL-SLR Report. No further NRC staff evaluation is necessary.

If the applicant does not reference the GALL-SLR Report in its renewal application, additional NRC staff evaluation is necessary to determine whether the applicant's ~~program~~TLAA analysis and EQ AMP is acceptable for this area of review.

4.4.3.2 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer verifies that the applicant has provided information to be included in the FSAR supplement that includes a summary description of the TLAA evaluation of the ~~environmental qualification of~~applicant's EQ AMP including time dependent electric equipment. Table 4.4-2 contains examples of acceptable FSAR supplement information for this TLAA. The reviewer verifies that the applicant has provided a FSAR supplement with information ~~equivalent to~~ consistent with that in Table 4.4-2~~.~~ including plant-specific commitments, license conditions, enhancements or exceptions.

~~The staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. The staff will review any such changes when the next update is submitted. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.~~

As noted in Table 4.4-2, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified ~~and committed~~ in the ~~license renewal application to~~SLRA any future aging management activities, including commitments, license conditions, enhancements, and ~~commitments~~exceptions to be ~~completed before~~implemented prior to or during the subsequent period of extended operation. ~~The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.~~

4.4.4 Evaluation of Findings

The reviewer determines whether the applicant has provided information sufficient to satisfy the provisions of this section and whether the ~~staff's~~applicant's evaluation supports conclusions of the ~~following type,~~applicant's TLLA evaluation. Depending on the applicant's ~~choice~~selection, a review of the applicant's 10 CFR 54.21(c)(1)(i), (ii), or (iii~~),~~) evaluation is to be included in the NRC staff's Safety Evaluation Report~~:~~.

The NRC staff confirms that the FSAR supplement contains a sufficiently detailed summary description with key AMP attributes identified in the FSAR summary description. The NRC staff also confirms the FSAR summary provides a summary description of any commitments, license conditions, enhancements, or exceptions as appropriate.

On the basis of its review, ~~as discussed above,~~ the NRC staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.2 (c)(1), that, for the environmental qualification of Electric Equipment TLAA, [choose which is appropriate] (i) the analyses remain valid for the subsequent period of extended operation, (ii) the analyses have been projected to the end of the subsequent period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the subsequent period of extended operation~~. The staff also concludes that the FSAR supplement contains an appropriate summary description of the environmental qualification of electric equipment TLAA evaluation for the period of extended operation as reflected in the license condition~~.

4.4.5 Implementation

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

4.4.6 References

1. NRC. Regulatory Guide 1.89~~, Rev. 1~~, “Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants~~,”~~.” Revision 1. Washington, DC: U.S. Nuclear Regulatory Commission. June 1984.

2. NRC. “Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors~~,” (~~.” DOR Guidelines~~),~~. Washington, DC: U.S. Nuclear Regulatory Commission. November 1979.

3. NRC. NUREG~~-~~-0588, “Interim Staff Position on Environmental Qualification of Safety-Related Equipment~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. July 1981.

4. IEEE~~ STD~~. Standard 323-1971, “IEEE Trial Use Standard; General Guide for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.” New York City, New York: Institute of Electrical and Electronics Engineers.

5. IEEE~~ STD~~. Standard 323-1974, “IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.” New York City, New York: Institute of Electrical and Electronics Engineers.

6. IEEE~~ STD~~. Standard 382-1972, “Standard for Qualification of Actuators for Power Operated Valve Assemblies with Safety Related Functions for Nuclear Power Plants.” New York City, New York: Institute of Electrical and Electronics Engineers.

7. IEEE~~ STD~~. Standard 334-1971, “IEEE Standard for Type Tests of Continuous Duty Class 1E Motors for Nuclear Power Generating Stations.” New York City, New York: Institute of Electrical and Electronics Engineers.

8. NRC. Regulatory Issue Summary 2003-09, “Environmental Qualification of Low-Voltage Instrumentation and Control Cables~~,”~~.” Washington, DC: U.S. Nuclear Regulatory Commission. May 2, 2003.

~~9. Generic Safety Issue -168,~~NRC. “Environmental Qualification of Low-Voltage Instrumentation and Control Cables~~,” February 2001.~~

~~10.~~9. ~~NUREG-1801, “~~.” Generic ~~Aging Lessons Learned (GALL) Report,”~~Safety Issue-168. Washington, DC: U.S. Nuclear Regulatory Commission~~, Revision 2, 2010.~~. February 2001.

11. CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Washington, DC: U.S. Nuclear Regulatory Commission. 2009.

12. CFR 50.49, “Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. 2014.

13. NRC. Regulatory Guide 1.211, “Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. April 2009.

14. NRC. Regulatory Guide 1.100, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants." Washington, DC: U.S. Nuclear Regulatory Commission. September 2009.

15. NRC. Regulatory Guide 1.218, "Condition-Monitoring Techniques for Electric Cables Used in Nuclear Power Plants." Washington, DC: U.S. Nuclear Regulatory Commission. April 2012.

16. IEEE, Standard 1205-2014, **"**IEEE Guide for Assessing, Monitoring, and Mitigating Aging Effects on Electrical Equipment Used in Nuclear Power Generating Stations and Other Nuclear Facilities.**"** New York City, New York: Institute of Electrical and Electronics Engineers.

Table 4.4-1. Environmental Qualification Reanalysis Attributes	
Reanalysis Attributes	**Description**
Analytical methods	The analytical models used in the reanalysis of an aging evaluation ~~should be~~are the same as those previously applied during the prior evaluation. The Arrhenius methodology is an acceptable thermal model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (i.e., normal radiation dose for the projected installed life plus accident radiation dose). For ~~license renewal~~SLR, one acceptable method of establishing the 80-year normal radiation dose is to multiply the 60-year normal radiation dose ~~is to multiply the 40-year normal radiation dose~~ by ~~1.5~~2.0 (i.e., ~~60~~80 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For ~~cyclical~~aging effects attributed to cyclic aging, a similar approach may be used. Other models may be justified on a case-by ~~-~~case basis.
Data collection and reduction methods	~~Reducing~~The identification of excess ~~conservatisms~~conservatism in ~~the component~~electrical equipment service conditions (for example, temperature, radiation, and cycles) used in the prior aging evaluation is the chief method used for a reanalysis. For example, temperature data and uncertainties used in an ~~aging~~equipment EQ evaluation ~~should~~may be ~~conservative and~~ based on the anticipated plant design temperatures ~~or on~~found to be conservative when compared to actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for technical specification compliance~~,~~; other installed monitors, measurements made by plant operators during rounds, ~~and temperature sensors on large motors (while the motor is not running).~~ or dedicated monitoring equipment for EQ. A representative number of temperature measurements ~~are conservatively~~over a sufficient period of time are evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation or (b) using the plant temperature data

Table 4.4-1. Environmental Qualification Reanalysis Attributes

Reanalysis Attributes	Description
	to demonstrate conservatism when using plant design temperatures for an evaluation. The methodology for environmental monitoring, data collection and the analysis of localized EQ equipment environmental data (including temperature and radiation) used in the reanalysis is justified in the record of the reanalysis qualification report. Environmental monitoring data used in the analysis that is collected one time, or is of limited duration, is justified with respect to the applicability of such data to the reanalysis. Any changes to material activation energy values included as part of a reanalysis ~~should be~~are justified~~.~~ by the applicant on a plant-specific basis. Similar methods of ~~reducing~~identifying excess ~~conservatisms~~conservatism in the ~~component~~equipment service ~~conditions used in prior aging evaluations~~condition evaluation can be used for radiation and ~~cyclical~~cyclic aging.
Underlying assumptions	~~Environmental qualification component~~EQ equipment aging evaluations contain ~~sufficient conservatisms~~ conservatism to account for most environmental changes occurring due to plant modifications and events. ~~When unexpected adverse~~ A reanalysis demonstrates that adequate margin is maintained consistent with the original analysis in accordance with 10 CFR 50.59 requiring certain margins and accounting for the unquantified uncertainties established in the EQ aging evaluation of the equipment. A reanalysis that utilizes initial qualification conservatisms and/or in-service environmental conditions (e.g., actual temperature and radiation conditions) are part of an EQ program. Adverse localized environments are identified during periodic inspections, or by operational or maintenance activities that affect the operating environment of ~~a~~an environmentally qualified component, the affected ~~environmental qualification~~ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions~~.~~ (e.g., changes to qualified life).

Table 4.4-1. Environmental Qualification Reanalysis Attributes	
Reanalysis Attributes	**Description**
Acceptance criteria and corrective actions	The reanalysis of an aging evaluation ~~should~~is used to extend the environmental qualification of ~~the~~a component. If the qualification cannot be extended by reanalysis, the component must be refurbished, replaced, or requalified prior to exceeding the current qualified life. A reanalysis should be performed in a timely manner (such that sufficient time is available to refurbish, replace, or requalify the component if the reanalysis is ~~unsuccessful).~~unfavorable). A modification to qualified life either by reanalysis or ongoing qualification must demonstrate that adequate margin is maintained consistent with the original analysis including unquantified uncertainties established in the original EQ equipment aging valuation.

Table 4.4-1. Environmental Qualification Reanalysis Attributes	
Reanalysis Attributes	**Description**

~~**Table 4.4-2 Examples of FSAR Supplement for Environmental Qualification of Electric Equipment TLAA Evaluation**~~		
~~**10 CFR 54.21(c)(1)(i) Example**~~		
~~**TLAA**~~	~~**Description of Evaluation**~~	~~**Implementation Schedule***~~
~~Environmental qualification of electric equipment~~	~~The original environmental qualification qualified life has been shown to remain valid for the period of extended operation.~~	~~Completed~~
~~**10 CFR 54.21(c)(1)(ii) Example**~~		
~~**TLAA**~~	~~**Description of Evaluation**~~	~~**Implementation Schedule***~~
~~Environmental qualification of electric equipment~~	~~The environmental qualification has been projected to the end of the period of extended operation. Reanalysis addresses 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 of electric equipment~~Ongoing Qualification	~~The existing~~ As an alternative to reanalysis when assessed margins, conservatisms, or assumptions do not support reanalysis (e.g., extending qualified life) of an EQ component, the use of on-going qualification techniques including condition monitoring or condition based methodologies may be implemented as a means to provide reasonable assurance that an equipment environmental qualification ~~process, in accordance with 10 CFR 50.49, will adequately manage aging of environmental qualification equipment~~ is maintained for the subsequent period of extended operation ~~because~~. On-going qualification of electric equipment ~~will be replaced prior to reaching the end of its qualified life. Reanalysis addresses attributes of analytical methods, data collection and~~	~~Existing program~~

Table 4.4-1. Environmental Qualification Reanalysis Attributes		
Reanalysis Attributes	**Description**	
	~~reduction methods, underlying assumptions,~~important to safety subject to the requirements of 10 CFR 50.49 involves the inspection, observation, measurement, or trending of one or more indicators, which can be correlated to the condition or functional performance of the EQ equipment. On-going Qualification techniques, including condition based monitoring, provide information that may be used in the determination a component's ability to perform its safety function and the components remaining qualified life for the subsequent period of extended operation. On-going qualification techniques for EQ equipment include, as applicable, periodic testing, inspections, mitigation, sampling (e.g., subsequent EQ qualification testing of inservice or representative EQ equipment with established acceptance criteria~~,~~ and 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~~(e.g., mitigation, replacement or refurbishment) consistent with endorsed standards and regulatory guidance.	

~~* An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.~~

Table 4.4-2. Examples of FSAR Supplement for Environmental Qualification Electric Equipment TLAA Evaluation

	10 CFR 54.21(c)(1)(i) Example		
	TLAA	**Description of Evaluation**	**Implementation Schedule***
4.4	Environmental qualification of electric equipment	The original environmental qualification qualified life has been shown to remain valid for the period of extended operation. [Plant specific identification and summary descriptions of commitments, license conditions, enhancements or exceptions are also described as applicable]	
	10 CFR 54.21(c)(1)(ii) Example		
	TLAA	**Description of Evaluation**	**Implementation Schedule***
4.4	Environmental qualification of electric equipment	The environmental qualification has been projected to the end of the period of extended operation. [The summary report addresses the key reanalysis attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions]. [Plant specific identification and summary descriptions of commitments, license conditions, enhancements or exceptions are also described as applicable]	Completed
	10 CFR 54.21(c)(1)(iii) Example		
	TLAA	**Description of Evaluation**	**Implementation Schedule**
4.4	Environmental qualification of electric equipment	The applicant's environmental qualification process, in accordance with 10 CFR 50.49, will adequately manage aging of environmental qualification equipment for the period of extended operation because equipment will be replaced prior to reaching the end of its qualified life. [The summary report addresses the key reanalysis attributes of methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions.]	Existing program

Table 4.4-2. Examples of FSAR Supplement for Environmental Qualification Electric Equipment TLAA Evaluation

		[The applicant states that its environmental qualification program contains the same elements evaluated in the GALL-SLR Report.] [Plant specific identification and summary descriptions of commitments, license conditions, enhancements or exceptions are also described as applicable]	

4.5 Concrete Containment ~~TENDON PRESTRESS~~ Unbonded Tendon Prestress Analysis

Review Responsibilities

Primary~~ - ~~—Branch responsible for ~~TLAA issues~~structural engineering

Secondary~~ - ~~—Branch responsible for structural engineering

4.5.1 Areas of Review

The prestressing tendons in prestressed concrete containments ~~lose their~~undergo losses in prestressing forces with time due to creep and shrinkage of concrete and relaxation of the prestressing steel. During the design phase, engineers ~~estimate~~estimated these losses to ~~arrive at~~ the end of the prestressed containment operating life~~ (Refs. 1 and 2),~~, normally 40 years. ~~The~~ Operating experiences with the trend of prestressing forces indicate ~~that~~ the prestressing tendons lose their prestressing forces at a rate higher than predicted due to sustained high temperature~~ (Ref. 3).~~. In addition, loss of prestress or reduction in tendon force can occur due to breakage of tendon wires or improper anchorages. Stress corrosion cracking (SCC) in individual tendons can also occur and contribute to the loss of tendon prestress if there is a susceptible material and environment combination. Moreover, consideration should be given to an increased tendon relaxation when replacing existing in service tendons with new. Thus, it is necessary to ensure that the applicant addresses existing Time Limited Aging Analyses (TLAAs ~~for the extended period of operation.~~) for the subsequent period of extended operation. Plant specific TLAAs regarding loss of prestress [e.g., predicted tendon prestress force lower limit–predicted lower limit (PLL), bonded tendons] are addressed and reviewed in Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses."

The adequacy of the prestressing forces in prestressed concrete containments is reviewed for the subsequent period of extended operation.

4.5.2 Acceptance Criteria

The acceptance criteria for the area of review described in Subsection 4.5.1 delineate acceptable methods for meeting the requirements of the ~~NRC's~~U.S. Nuclear Regulatory Commission (NRC) regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c)(1).

4.5.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1)(i) - (iii), an applicant must demonstrate one of the following:

(i) The analyses remain valid for the subsequent period of extended operation;

(ii) The analyses have been projected to the end of the ~~extended~~subsequent period of extended operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the subsequent 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 (a) losses of the prestressing force are less than the predicted losses, as evidenced from the trend lines constructed from the recent inspection, (b) the period of evaluation covers the subsequent period of extended operation, and (c) the trend lines of the measured prestressing forces remain above the minimum required prestress force specified at anchorages for each group of tendons for the subsequent period of extended operation.

4.5.2.1.2 10 CFR 54.21(c)(1)(ii)

The ~~trend~~prediction line of prestressing forces for each group of tendons initially developed for 40 years of operation should be extended to ~~60~~80 years. The applicant ~~should demonstrate~~demonstrates through analysis the unbonded tendon prestressed concrete containment design adequacy remains valid and that the trend lines of the measured prestressing forces will stay above the design Minimum Required Value (MRV) in the current licensing basis (CLB) for each group of tendons during the subsequent 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 minimum required prestress force specified at anchorages 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 Chapter X of the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report ~~(Ref. 4),~~, the NRC staff evaluated a program that assesses the concrete containment tendon prestressing forces~~,~~ [aging management program (AMP) X.S1, "Concrete Containment Unbonded Tendon Prestress"], and has determined that it is an acceptable ~~aging management program~~ AMP to address concrete containment tendon prestress according to 10 CFR 54.21(c)(1)(iii), except for operating experience. ~~The GALL Report recommends~~ Further evaluation is recommended of the applicant's operating experience related to the containment prestress force. However, the GALL-SLR Report contains one acceptable way and not the only way to manage aging ~~for license renewal.~~

. The GALL-SLR report may be referenced in a subsequent license renewal application~~,~~ (SLRA), and is treated in the same manner as an approved topical report. ~~However, the GALL report contains one acceptable way, but not the only way, to manage aging for license renewal.~~

In referencing the GALL-SLR report, an applicant indicates that the material referenced is applicable to the specific plant involved and should provide the information necessary to adopt the finding of program acceptability as described and evaluated in the report. An applicant also verifies that the approvals set forth in the GALL-SLR report for the generic program apply to the applicant's program.

4.5.2.2 ~~FSAR~~ Final Safety Analysis Report Supplement

The specific criterion for meeting 10 CFR 54.21(d) is:

The summary description of the evaluation of TLAAs for the subsequent period of extended operation in the ~~FSAR~~Final Safety Analysis Report (FSAR) supplement is appropriate such that later changes can be controlled by 10 CFR 50.59. The description must contain information associated with the TLAAs regarding the basis for determining that the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

4.5.3 Review Procedures

For each area of review described in Subsection 4.5.1, the following review procedures should be followed:

4.5.3.1 Time-Limited Aging Analysis

For a concrete containment prestressing tendon system, the review procedures, depending on the applicant’s choice of 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 loss 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~~ remains valid for the subsequent 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 sampled tendon group) are considered in the regression analysis for the subsequent period of extended operation, as discussed in Information Notice (IN) 99-10 ~~(Ref. 3). Either the reviewer~~, “Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments.” The reviewer then verifies that the trend lines will stay above the minimum required prestressing forces for each group of tendons during the ~~period of extended operation or, if the trend lines fall below the minimum required prestressing forces during this period, the reviewer verifies that the applicant has a systematic plan for retensioning the tendons to ensure that the trend lines will return to being, and remain, above the minimum required prestressing forces for each group of tendons during the~~subsequent period of extended operation~~. If the applicant chooses to reanalyze the containment, the reviewer verifies~~ so that the design adequacy is maintained in the subsequent period of extended operation.

4.5.3.1.3 10 CFR 54.21(c)(1)(iii)

An applicant may reference the GALL-SLR Report in its ~~license renewal application~~SLRA, as appropriate. The reviewer verifies that the applicant has stated that the report is applicable to its plant with respect to its program that assesses the concrete containment tendon prestressing forces. The reviewer verifies that the applicant has identified the appropriate program (i.e., GALL ~~Chapter~~ -SLR Report AMP X.S1) as described and evaluated in the GALL-SLR Report. The reviewer also ensures that the applicant has stated that its program contains the same program elements that the NRC staff evaluated and relied upon in approving the corresponding generic program in the GALL-SLR Report.

~~The GALL Report recommends~~ Further evaluation is recommended of the applicant’s operating experience related to the containment prestress force. The applicant’s program should incorporate the relevant operating experience that occurred at the applicant’s plant as well as at other plants. The applicant considers applicable portions of the experience with prestressing systems described in ~~Information Notice~~ IN 99-~~-~~10 ~~(Ref. 3).~~. Tendon operating experience could vary among plants with prestressed concrete containments. The difference could be due to the prestressing system design (for example, button-heads, wedge or swaged anchorages), environment, or type of reactor [pressurized water reactor (PWR) or boiling water reactor (BWR~~).~~)]. The reviewer reviews the applicant’s program to verify that the applicant has adequately considered plant-specific operating experience.

If the applicant does not reference the GALL-SLR Report in its ~~renewal application~~SLRA, additional NRC staff evaluation is necessary to determine whether the applicant’s program is acceptable for this area of review. The reviewer uses the guidance provided in Branch Technical Position (BTP) RLSB-1 of this Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-~~LR~~SLR) to ensure that loss of prestress in the concrete containment prestressing tendons is adequately managed ~~for the~~so that trend lines will remain above the minimum required prestressing forces for each group of tendons for the subsequent period of extended operation.

4.5.3.2 ~~FSAR~~Final Safety Analysis Report Supplement

The reviewer verifies that the applicant has provided information, to be included in the FSAR supplement, that includes a summary description of the evaluation of the tendon prestress TLAA. Table 4.5-1 contains examples of acceptable FSAR supplement information for this TLAA. The reviewer verifies that the applicant has provided ~~a~~an FSAR supplement with information equivalent to that in Table 4.5-1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the FSAR supplement before the license is renewed, no condition will be necessary.

As noted in Table 4.5-1, an applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the SLRA to any future aging management activities, including enhancements and commitments to be completed before the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

4.5.4 Evaluation Findings

The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of Section 4.5 and whether the NRC 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 Safety Evaluation Report:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the concrete containment tendon prestress TLAA, [choose which is appropriate] (i) the analyses remain valid for the subsequent period of extended operation, (ii) the analyses have been projected to the end of the subsequent period of extended operation, or (iii) the effects of aging on the

intended function(s) will be adequately managed for the subsequent period of extended operation. The NRC staff also concludes that the FSAR supplement contains an appropriate description of the concrete containment tendon prestress TLAA evaluation for the subsequent period of extended operation as reflected in the license condition.

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 NRC staff in its evaluation of conformance with NRC regulations.

4.5.6 References

1. NRC. Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments." Washington, DC: U.S. Nuclear Regulatory Commission. ML003740040. July 1990.

2. NRC. Information Notice 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments." ML031500244. Washington, DC: U.S. Nuclear Regulatory Commission. April 1999.

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 loss of coolant accident (LOCA). The prestressing forces generated by the tendons diminish over time due to losses in prestressing forces in the tendons and in the surrounding concrete. The prestressing force review and evaluation has been completed and determined to remain valid to the end of the subsequent period of extended operation, and the trend lines of the measured prestressing forces will stay above the minimum required prestressing forces for each group of tendons to the end of this period.	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 forces in the tendons and in the surrounding concrete. The prestressing force analysis and evaluation has been completed and determined to remain within allowable limits to the end of the subsequent period of extended operation, and the trend lines of the measured pre-stressing forces will stay above the minimum required prestressing forces for each group of tendons to the end of this period.	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 prestressing forces in the tendons and in the surrounding concrete. The [identify the AMP] developed to monitor the prestressing forces will ensure that, during each inspection, the trend lines of the measured prestressing forces show that they meet the requirements of the ASME Code, Section XI, Subsection IWL, as incorporated by reference in 10 CFR 50.55a and	Program should be implemented before the subsequent period of extended operation.

Table 4.5-1. Examples of FSAR Supplement for Concrete Containment Tendon Prestress TLAA Evaluation		
	supplemented. If the trend lines cross the PLLs, corrective actions should be taken. The program incorporates plant-specific and industry operating experience.	
*An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the subsequent period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.		

4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis

Review Responsibilities

Primary—Branch responsible for structural engineering

Secondary—Branch responsible for mechanical engineering

4.6.1 Areas of Review

This section addresses fatigue analyses for containment metal liner plates, metal containments [including boiling water reactor (BWR) containment suppression chamber and the vent system), and penetrations (including personnel airlocks, equipment hatches, sleeves, dissimilar metal welds, and bellows].

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 Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix J. The thickness of the liner plates is generally between 1/4-in [6.2 mm] and 3/8-in [9.5 mm]. The liner plates are attached to the concrete containment wall by stud anchors or structural rolled shapes or both. The design process assumes that the liner plates do not carry loads. However, imposed loads or conditions (e.g., dead, seismic, thermal, internal pressure, creep and shrinkage) induce cyclic stresses in the liner plates. Thus, under design-basis conditions, the liner plates could experience cyclic strains. Some plants may have metal containments instead of concrete containments with liner plates. The metal containments are designed to carry dead loads and seismic loads in addition to the internal pressure and temperature loads. For BWR Mark I metal containments, the containment suppression pool torus chamber (wetwell) and the vent system are designed or evaluated for hydrodynamic loads associated with actuation of safety relief valves and the discharge into the suppression pool chamber.

Fatigue of the containment liner plates or metal containments may be considered in the design based on an assumed number of occurrences and severities of cyclic loads for the current operating term. The cyclic loads include reactor building interior temperature variations during heatups and cooldowns of the reactor coolant system, loss of coolant accident (LOCA) as applicable, 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. The BWR containment suppression pool chamber and the vent system are designed or evaluated for the hydrodynamic cyclic loads as described in Section 6.2.1.1.C, "Pressure-Suppression Type BWR Containments," of NUREG–0800, "Standard Review Plan."

Electrical penetration assemblies are usually sealed canisters penetrating the containment liner plate or metal containment barrier such that a pressure boundary between the inboard and outboard sides of the penetration exists while maintaining electrical continuity through the device. Mechanical penetrations include piping penetrations, access penetrations, drywell head, and fuel transfer tubes. High energy piping penetrations and the fuel transfer tubes in some plants are equipped with stainless steel (SS) bellow assemblies. These penetrations accommodate loads from relative movements between the containment wall (including the liner) and the adjoining structures, and from Type B, local leak rate tests. The penetrations have sleeves (up to 3 m [10 ft] in length, with a 5- to 8-cm [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 or SS plates to provide essentially leak-tight penetrations. Historical maintenance records, industry operating experience, and aging mechanisms that include degradation due to fatigue and their effects on electrical and mechanical penetrations, are discussed in Electric Power Research Institute (EPRI) Report "Aging Management Guideline for Commercial Nuclear Power Plants Electrical and Mechanical Penetrations."

The containment metal liner plates, metal containments (including BWR containment suppression chamber and the vent system), and penetrations (including personnel airlocks, equipment hatches, sleeves, dissimilar metal welds, and bellows), may be designed in accordance with requirements of Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code[1]. If a plant's code of record requires a fatigue parameter evaluation (fatigue analysis or fatigue waiver), then this analysis may be a time-limited aging analysis (TLAA) and should be evaluated in accordance with 10 CFR 54.21(c)(1) for the subsequent license renewal (SLR) period.

The adequacy of the fatigue parameter evaluations of the containment liner plates, metal containments, and penetrations is reviewed in this section for the subsequent period of extended operation. The number of cyclic load occurrences assumed in the fatigue parameter evaluations should be clearly identified in Section 4.6 of the applicant's subsequent license renewal application (SLRA). The fatigue parameter evaluations of the pressure boundary of process piping are reviewed separately following the guidance in Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Section 4.3, "Metal Fatigue."

4.6.1.1 Time-Limited Aging Analysis (Fatigue Parameter Evaluations)

The ASME Code contains explicit requirements for fatigue parameter evaluations (fatigue analyses or fatigue waivers), which are TLAAs. Specific requirements are contained in the design code of reference for each plant. The severities and the numbers of cycles of actual loadings for each cyclic load assumed in the underlying analyses should be verified against the numbers and severities of the actual loads projected for the subsequent period of extended operation. Monitoring of cyclic loading is accomplished through a TLAA aging management program (AMP) consistent with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report, X.M1 "Cyclic Load Monitoring," or through a site-specific AMP consistent with the guidance provided in the SRP-SLR, Appendix A.1, "Branch Technical Position, Aging Management Review—Generic."

4.6.1.1.1 Fatigue Analyses (ASME Section III, MC or Class 1)

ASME, Boiler and Pressure Vessel (B&PV) Code, Section III, Division 2, "Code for Concrete Containments, Rules for Construction of Nuclear Facility Components," and ASME B&PV Code, Section III, Division 1, "Subsection NE, Class MC Components, Rules for Construction of Nuclear Facility Components," require a fatigue analysis for liner plates, metal containments, and penetrations that considers all cyclic loads based on the anticipated number of cycles. Containment components also may be designed to ASME Section III Class 1 requirements. A

[1]GALL-SLR Report Chapter 1, Table 1, identifies the ASME Code Section XI editions and addenda that are acceptable to use of AMPs.

Section III, MC or 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 less than or equal to one for acceptable fatigue design. The fatigue resistance of the liner plates or metal containments, and penetrations during the subsequent period of extended operation is an area of review.

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) Titles or NE-3366.2(e)(3) standards.

4.6.1.1.2 Fatigue Waiver Evaluations

The current licensing basis (CLB) may include fatigue waiver evaluations that preclude the need for performing CUF analyses of structural components. The American Society of Mechanical Engineers (ASME) Code Section III rules for performing fatigue waiver evaluations for structural components are analogous to those in the Code for performing fatigue waiver evaluations of mechanical components. ASME Code NE-3131(d) Titles (1974 editions or later) rules out consideration for earthquake transients unless they impact designated liner locations recognized in the specifications. ASME Code NE-3222.4(d) “Analysis for Cyclic Operations, Vessels Not Requiring Analysis for Cyclic Operation,” provides for a waiver from fatigue analysis when certain cyclic loading criteria are met.

4.6.1.2 Final Safety Analysis Report Supplement

The SLRA contains TLAA information for containment liner plates, metal containments, and penetrations. A summary description of the evaluation of containment liner plates, metal containments, and penetrations TLAAs for the subsequent period of extended operation is also contained in the applicant’s proposed 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 delineate acceptable methods for meeting the requirements of the U.S. Nuclear Regulatory Commission (NRC) regulations in 10 CFR 54.21(c)(1).

4.6.2.1 Time-Limited Aging Analysis

In some instances, the applicant may identify activities to be performed to verify the assumption bases of the fatigue parameter evaluations, the fatigue analyses, or the fatigue waiver evaluations. Evaluations of those activities are provided by the applicant. The reviewer assures that the applicant’s activities are sufficient to confirm the calculation assumptions for the SLR period.

Pursuant to 10 CFR 54.21(c)(1), an applicant must demonstrate one of the following:

(i) The analyses remain valid for the subsequent period of extended operation;

(ii) The analyses have been projected to the end of the subsequent period of extended operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the subsequent period of extended operation.

Specific acceptance criteria for fatigue of containment liner plates, metal containments, and penetrations are provided in the following subsections.

4.6.2.1.1 Fatigue Parameter Evaluations

For containment liner plates, metal containments, and penetrations that have fatigue parameter evaluations, the acceptance criteria are provided in the following subsections depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii). This section applies to the evaluations identified in Sections 4.6.1.1.1 and 4.6.1.1.2.

4.6.2.1.1.1 10 CFR 54.21(c)(1)(i)

The fatigue parameter evaluations remain valid because the numbers of occurrences and severities of assumed cyclic loads are not projected to be exceeded during the subsequent period of extended operation.

4.6.2.1.1.2 10 CFR 54.21(c)(1)(ii)

The fatigue parameter evaluations have been reevaluated based on revised numbers of occurrences and severities of assumed cyclic loads for the subsequent period of extended operation and have been shown to remain within the allowed limits.

4.6.2.1.1.3 10 CFR 54.21(c)(1)(iii)

The applicant proposes an AMP as the basis for demonstrating that the effect or effects of aging on the intended function(s) of the structure(s) or component(s) in the fatigue parameter evaluations will be adequately managed during the subsequent period of extended operation. GALL-SLR Report AMP X.M1 provides one method that may be used to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii).

An applicant may also propose another AMP to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii). If the basis for aging management is a plant-specific AMP, the AMP should be defined in terms of the 10 program elements defined in the SRP-SLR, Appendix A.1.

If an inspection program is proposed as the basis for aging management, the AMP implements inspections of the component(s) or structure(s) in the evaluation. The AMP justifies the inspection methods and frequencies that are applicable to the component(s) or structure(s), such that the TLAA will meet the requirement of 10 CFR 54.21(c)(1)(iii).

Consistent with the TLAA acceptance criterion in 10 CFR 54.21(c)(1)(iii), an AMP is proposed to accept the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) and to manage the effects of cumulative fatigue damage or fatigue-induced cracking on the intended functions of the components during the subsequent period of extended operation. GALL-SLR Report AMP XI.M1 provides one AMP that may be used as the basis for accepting the fatigue parameter evaluation in accordance with 10 CFR 54.21(c)(1)(iii). However, other Generic Aging Lessons Learned (GALL) AMPs or plant-specific AMPs or activities may be used to accept the TLAA in accordance 10 CFR 54.21(c)(1)(iii) if appropriately justified in the SLRA.

4.6.2.2 Final Safety Analysis Report Supplement

The summary description of the evaluation of TLAAs for the subsequent period of extended operation in the FSAR supplement is appropriate 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 the applicant has made the demonstration required by 10 CFR 54.21(c)(1).

4.6.3 Review Procedures

For each area of review described in Subsection 4.6.1, the review procedures in the following subsections should be used.

4.6.3.1 Time-Limited Aging Analysis

4.6.3.1.1 Fatigue Parameter Evaluations

For containment liner plates, metal containments, and penetrations with fatigue parameter evaluations, the review procedures are provided in the following subsections depending on the applicant’s choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii).

4.6.3.1.1.1 10 CFR 54.21(c)(1)(i)

The projected number of occurrences and severities of cyclic loadings at the end of the subsequent period of extended operation is compared to the number of occurrences and severities of cyclic loadings used in the existing fatigue parameter evaluations. The comparison confirms that the number of occurrences and severities of cyclic loadings in the existing fatigue parameter evaluations will not be exceeded during the subsequent period of extended operation.

4.6.3.1.1.2 10 CFR 54.21(c)(1)(ii)

The revised number of occurrences and severities of cyclic loadings projected to the end of the subsequent period of extended operation is reevaluated. The revised fatigue parameter evaluations based on the projected number of occurrences and severities of cyclic loads are reviewed to ensure that the calculated fatigue parameters remain less than the allowed values at the end of the subsequent period of extended operation.

If applicable, the code of record is used for the revised fatigue parameter evaluations, 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 54.21(c)(1)(iii)

Pursuant to 10 CFR 54.21(c)(1)(iii), the applicant proposes an AMP or aging management activities as the basis for demonstrating that the effect or effects of aging on the intended function(s) of the structure(s) or component(s) in the fatigue parameter evaluation will be adequately managed during the subsequent period of extended operation. If an AMP corresponding to GALL-SLR Report AMP X.M1 is used as the basis for managing cumulative fatigue damage or cracking due to fatigue or cyclical loading in the structure(s) or component(s), the reviewer reviews the applicant's AMP against the program elements defined in GALL-SLR Report AMP X.M1.

An applicant also has the option of proposing another GALL-based AMP, plant-specific AMP, or plant-specific activities, or combination thereof, to demonstrate compliance with the requirement in 10 CFR 54.21(c)(1)(iii). If another GALL-based AMP is proposed as the basis for aging management, the reviewer reviews the applicant's AMP against the program element criteria defined in the applicable AMP section in Appendix A of the GALL-SLR Report. If the basis for aging management is a plant-specific AMP or plant-specific aging management activities, the reviewer reviews the program element criteria for the AMP or activities against the criteria defined in the SRP-SLR, Appendix A.1, "Branch Technical Position, Aging Management Review—Generic," Sections A.1.2.3.1 through A.1.2.3.10.

If a sampling based inspection program (a type of condition monitoring program) is proposed as the basis for aging management, the reviewer ensures that the AMP actually performs inspections of the component(s) or structure(s) in the evaluation and that the applicant has appropriately justified that the inspection bases are capable of managing cumulative fatigue damage or cracking by fatigue or cyclical loading in the component(s) or structure(s), such that the TLAA may be accepted in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.3.2 Final Safety Analysis Report Supplement

The reviewer verifies that the applicant has provided information, to be included in the FSAR supplement, that includes a summary description of the fatigue parameter TLAA evaluations for the containment liner plates, metal containments, and penetrations. SRP-SLR Table 4.6-1 contains examples of acceptable FSAR Supplement information for this TLAA. The reviewer verifies that the applicant has provided an FSAR Supplement with information equivalent to that in Table 4.6-1.

The NRC staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.

As noted in Table 4.6-1, the applicant need not incorporate the implementation schedule into its FSAR. However, the review should verify that the applicant has identified and committed in the SLRA to any future aging management activities, including enhancements and commitments to be completed before the subsequent period of extended operation. The NRC staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.

4.6.4 Evaluation Findings

The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of this section and to support the following conclusions, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), to be included in the Safety Evaluation Report.

On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that the [the reviewer inserts the type of fatigue parameter evaluation] TLAA evaluations, [choose which is appropriate] (i) remains valid for the subsequent period of extended operation, (ii) has been projected to the end of the subsequent period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed during the subsequent period of extended operation. The NRC staff also concludes that the FSAR supplement contains an appropriate summary description of the [the reviewer inserts the type of fatigue parameter evaluation] TLAA evaluations for the subsequent period of extended operation as reflected in the license condition.

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 NRC staff in its evaluation of conformance with NRC regulations.

4.6.6 References

1. NRC. NUREG-0661, "Mark I Containment Long-Term Program Resolution of Generic Technical Activity A-7." Washington, DC: U.S. Nuclear Regulatory Commission. July 1980.

2. American Society of Mechanical Engineers, Boiler and Pressure Vessel (B&PV) Code, Section III, Division 2, "Code for Concrete Containments, Rules for Construction of Nuclear Facility Components," New York City, New York (as endorsed in Regulatory Guide 1.136, "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments.").

3. American Society of Mechanical Engineers, Boiler and Pressure Vessel (B&PV) Code, Section III, Division 1, "Subsection NE, Class MC Components, Rules for Construction of Nuclear Facility Components," New York City, New York.

4. American Society of Mechanical Engineers, Boiler and Pressure Vessel (B&PV) Code, Section III, Division 1, "Subsection NC, Class 2 Components, Rules for Construction of Nuclear Facility Components," New York City, New York.

5. Electric Power Research Institute (EPRI) TR-1003456, "Aging Management Guideline for Commercial Nuclear Power Plants Electrical and Mechanical Penetrations," Palo Alto, California, April 2002.

Table 4.6-1. Examples of FSAR Supplement for Containment Liner Plates, Metal Containments, and Penetrations Fatigue TLAA Evaluation

10 CFR 54.21(c)(1)(i) Example		
TLAA	**Description of Evaluation**	**Implementation Schedule***
Containment Liner Plates, Metal Containments, and Penetrations Fatigue	The containment liner plates, metal containments, and penetrations provide an essentially leak-tight barrier. Current fatigue parameter evaluations remain valid during the subsequent period of extended operation.	Completed
10 CFR 54.21(c)(1)(ii) Example		
TLAA	**Description of Evaluation**	**Implementation Schedule***
Containment Liner Plates, Metal Containments, and Penetrations Fatigue	The containment liner plates, metal containments, and penetrations provide an essentially leak-tight barrier. Fatigue parameter evaluations have been reevaluated based on revised numbers of occurrences and severities of cyclic loads projected for the subsequent period of extended operation. The revised fatigue parameter values remain within allowable limits for the subsequent period of extended operation.	Completed
10 CFR 54.21(c)(1)(iii) Example		
TLAA	**Description of Evaluation**	**Implementation Schedule***
Containment Liner Plates, Metal Containments, and Penetrations Fatigue	The containment liner plates, metal containments, and penetrations provide an essentially leak-tight barrier. The applicant identifies an aging management program (AMP) to manage the effects of fatigue on such components during the subsequent period of extended operation. The program monitors and tracks the number of cycles and occurrences and severities of relevant transients. The program is effective when fatigue evaluations and/or fatigue usage remain within the allowable limits or requires corrective actions (e.g., reanalyses and/or component replacement) when the limits are exceeded. If the component is replaced, the fatigue parameter value for the replacement should be shown to be less than the allowable limit during the subsequent period of extended operation.	Proposed TLAA AMP should be implemented before the subsequent period of extended operation.

*An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the subsequent license renewal application to any future aging management activities to be completed before the subsequent period of extended operation. The NRC staff expects to impose a license condition on any subsequent renewed license to ensure that the applicant will complete these activities no later than the committed date.

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).

4.7 Other Plant-Specific Time-Limited Aging Analyses

Review Responsibilities

Primary—Office of Nuclear Reactor Regulation (NRR) branch responsible for the time-limited aging analysis (TLAA) issues

Secondary—Other branches responsible for systems, as appropriate

4.7.1 Areas of Review

There are certain plant-specific safety analyses that may involve time-limited assumptions defined by the current operating term of the plant (for example, aspects of the reactor vessel design) and may, therefore, be TLAAs. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c), a subsequent license renewal (SLR) applicant is required to evaluate TLAAs. The definition of TLAAs is provided in 10 CFR 54.3 and in Section 4.1 of this Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR).

As indicated in 10 CFR 54.30, the adequacy of the plant's current licensing basis (CLB) is not an area within the scope of the SLR review. Any questions regarding the adequacy of the CLB must be addressed under the backfit rule (10 CFR 50.109) and are separate from the license renewal process. SLR reviews focus on the subsequent period of extended operation. Pursuant to 10 CFR 54.30, if the reviews required by 10 CFR 54.21(a) or (c) show that there is not 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 functions of those systems, structures, and components (SSCs) are 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 within the scope of the SLR review.

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 U.S. Nuclear Regulatory Commission (NRC) staff reviews the applicant's identification of TLAAs and exemptions separately, following the guidance in Section 4.1 of this SRP-SLR.

The NRC staff has developed review procedures for the evaluation of certain TLAAs. If an applicant identifies these TLAAs as applicable to its plant, the NRC staff reviews them separately, following the guidance in Sections 4.2 through 4.6 of this SRP-SLR.

Table 4.7-1 provides examples of potential plant-specific TLAA topics. The reviewer follows the generic guidance in this section of the SRP-SLR for reviewing these and any other plant-specific TLAAs that have been identified by the applicant. For particular systems, the reviewers from branches responsible for those systems may be requested to assist in the review, as appropriate.

The following sub-sections identify the areas of review for plant-specific TLAAs.

4.7.1.1 Time-Limited Aging Analysis

The applicant's evaluation of the TLAA for the subsequent period of extended operation is reviewed.

4.7.1.2 Final Safety Analysis Report Supplement

The FSAR supplement summarizing the applicant's evaluation of the TLAA for the subsequent period of extended operation is reviewed.

4.7.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Section 4.7.1 delineate acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1) and 10 CFR 54.21(d).

4.7.2.1 Time-Limited Aging Analysis

Pursuant to 10 CFR 54.21(c)(1), an applicant must demonstrate one of the following for TLAAs:

(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.

Acceptance criteria for each TLAA demonstration are discussed in the following subsections.

4.7.2.1.1 10 CFR 54.21(c)(1)(i)

The applicant must demonstrate that the analysis remains valid for the subsequent period of extended operation. The analysis remains valid because it is shown to be bounding even during the subsequent period of extended operation. No changes to the existing analysis are necessary.

4.7.2.1.2 10 CFR 54.21(c)(1)(ii)

The applicant must demonstrate that the analysis has been projected to the end of the subsequent period of extended operation. The existing analysis is updated or recalculated to show acceptable results for the subsequent period of extended operation.

4.7.2.1.3 10 CFR 54.21(c)(1)(iii)

The applicant must demonstrate that the effects of aging on the intended function(s) will be adequately managed for the subsequent period of extended operation. Appendix A.1 of this SRP-SLR provides the acceptance criteria for programs and activities used to manage the effects of aging.

4.7.2.2 Final Safety Analysis Report Supplement

The summary description of the applicant's TLAA evaluation should be sufficiently comprehensive such that later changes can be controlled by 10 CFR 50.59. The summary description should identify which demonstration from 10 CFR 54.21(c)(1) was chosen and provide the results of the evaluation used to make that demonstration.

4.7.3 Review Procedures

For certain applicants, plant-specific analyses may meet the definition of a TLAA as given in 10 CFR 54.3. The concern for SLR is that these analyses may not have properly considered the full length of the subsequent period of extended operation, which may change conclusions with regard to safety and the capability of SSCs within the scope of the Rule to perform or one or more safety functions. The review of these TLAAs provides assurance that the effects of aging are properly addressed through the subsequent period of extended operation.

The following sub-sections provide the review procedures for each area of review described in Section 4.7.1.

4.7.3.1 Time-Limited Aging Analysis

For each TLAA, the review procedures depend on the applicant's choice of methods of compliance in 10 CFR 54.21(c)(1)(i), (ii), or (iii).

4.7.3.1.1 10 CFR 54.21(c)(1)(i)

Justification provided by the applicant is reviewed to verify that the existing analysis remains valid for the subsequent period of extended operation. The existing analysis should be shown to be bounding even during the subsequent period of extended operation.

The applicant describes the TLAA with respect to the objectives of the analysis, assumptions used in the analysis, conditions, acceptance criteria, relevant aging effects, and intended function(s). For those analyses that consider cyclic loading, each load or transient type should be identified along with the corresponding number of total cycles assumed in the analysis and the number of cycles that are anticipated to occur through the subsequent period of extended operation. The applicant shows that (a) conditions and assumptions used in the analysis already address the relevant aging effects for the subsequent period of extended operation, and (b) acceptance criteria are maintained to provide reasonable assurance that the intended function(s) is maintained. Thus, no reanalysis is necessary.

In some instances, the applicant may identify activities to be performed to verify the assumption basis for the calculation (e.g., cycle counting). An evaluation of that activity is provided by the applicant. The reviewer assures that the applicant's verification activities are sufficient to confirm the validity of the calculation assumptions for the subsequent period of extended operation.

If the TLAA must be modified or recalculated to extend the period of evaluation to consider the subsequent period of extended operation, then reevaluation should be addressed under 10 CFR 54.21(c)(1)(ii).

4.7.3.1.2 10 CFR 54.21(c)(1)(ii)

The documented results of the revised analyses are reviewed to verify that their period of evaluation is extended such that they are valid for the subsequent period of extended operation. The applicable analysis technique can be the one that is in effect in the plant's CLB at the time that the subsequent license renewal application (SLRA) is filed.

The applicant may recalculate the TLAA using an 80-year period to show that the acceptance criteria continue to be satisfied for the subsequent period of extended operation. The applicant also may revise the TLAA by recognizing and reevaluating 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 an 80-year period. The applicant should provide a sufficient description of the analysis and document the results of the reanalysis to show that it is satisfactory for the subsequent period of extended operation.

As applicable, the plant's code of record is used for the reevaluation, 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.

In some cases, the applicant may identify activities to be performed to verify the assumption basis for the calculation (e.g., cycle counting). An evaluation of that activity is provided by the applicant. The reviewer assures that the applicant's verification activities are sufficient to confirm the validity of the calculation assumptions for the subsequent period of extended operation.

4.7.3.1.3 10 CFR 54.21(c)(1)(iii)

Under this option, the applicant proposes to manage the aging effects associated with the TLAA by an aging management program (AMP) or aging management activities in the same manner as described in the integrated plant assessment (IPA) in 10 CFR 54.21(a)(3). The reviewer reviews the applicant's AMP or aging management activities to verify that the effects of aging on the intended function(s) are adequately managed consistent with the CLB for the subsequent period of extended operation.

The applicant identifies the structures and components (SCs) associated with the TLAA. The TLAA is described with respect to the objectives of the analysis, conditions, assumptions used, acceptance criteria, relevant aging effects, and intended function(s). The reviewer uses the guidance in Section A.1 of this SRP-SLR to ensure that the effects of aging on the SC-intended function(s) are adequately managed for the subsequent period of extended operation.

4.7.3.2 Final Safety Analysis Report Supplement

The reviewer verifies that the applicant has provided information to be included in the Final Safety Analysis Report (FSAR) supplement that includes a summary description of the evaluation of each TLAA. Each such summary description is reviewed to verify that it is sufficiently comprehensive.

The NRC staff expects to impose a condition on any subsequently renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, then no such condition ~~will be~~is necessary.

~~As noted in Table 4.5-1, an~~The applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the ~~license renewal application~~ SLRA to any future aging management activities, including enhancements and commitments to be completed before the subsequent period of extended operation. The NRC staff expects to impose a ~~license~~ condition on any subsequently renewed license to ~~ensure that~~require the applicant ~~will~~to complete these activities no later than the committed date.

4.~~5~~7.4 Evaluation Findings

The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of Section 4.7 and whether the NRC 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 Safety Evaluation Report:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the (name of specific) TLAA, [choose which is appropriate]

(i) The analyses remain valid for the subsequent 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 subsequent period of extended operation. The NRC staff also concludes that the FSAR supplement contains an appropriate summary description of this TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein is used by the NRC staff in its evaluation of conformance with NRC regulations.

4.7.6 References

None

Table 4.7-1. Examples of Potential Plant-Specific TLAA Topics
BWRs
Re-flood thermal shock of the reactor pressure vessel
Re-flood thermal shock of the core shroud and other reactor vessel internals
Loss of preload for core plate rim hold-down bolts
Erosion of the main steam line flow restrictors
Susceptibility to irradiation-assisted stress corrosion cracking
PWRs
Reactor pressure vessel underclad cracking
Leak-before-break
Reactor coolant pump flywheel fatigue crack growth
Response to NRC Bulletin 88-11, “Pressurizer Surge Line Thermal Stratification”
Response to NRC Bulletin 88-08, “Thermal Stresses in Piping Connected to Reactor Cooling Systems”
BWRs and PWRs
Fatigue of cranes (crane cycle limits)
Fatigue of the spent fuel pool liner
Corrosion allowance calculations
Flaw growth due to stress corrosion cracking
Predicted lower limit
Grouted tendon prestress systems, structures, and components

5 TECHNICAL SPECIFICATIONS CHANGES

5.1 Review of Technical Specifications Changes and Additions Necessary to Manage the Effects of Aging During the Subsequent Period of Extended Operation

Review Responsibilities

Primary— Division of License Renewal (DLR) technical branch for reviewing applicable technical specifications (TS) requirements for relevance to specific aging management programs (AMPs) or time-limited aging analyses (TLAAs)

Secondary—DLR projects branch responsible for processing of the subsequent license renewal application (SLRA); supporting branches in Office of Nuclear Reactor Regulation, Division of Engineering (NRR/DE); Office of Nuclear Reactor Regulation, Division of Inspection and Regional Support (NRR/DIRS); Office of Nuclear Reactor Regulation, Division of Policy and Rulemaking (NRR/DPR); Office of Nuclear Reactor Regulation, Division of Operating Reactor Licensing (NRR/DORL) or Office of Nuclear Reactor Regulation, Division of Safety Systems (NRR/DSS)

5.1.1 Areas of Review

The requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.22 (Ref. 2) require an applicant to identify any new TSs or TS changes (i.e., amendments) that are needed to manage the effects of aging during the period of extended operations. This section of the Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) provides guidance for determining whether plant TS changes need to be included in a plant-specific SLRA.

5.1.2 Acceptance Criteria

The TS for a relicensed light-water reactor facility may contain specific TS sections that may have relationships to AMPs or TLAAs that are identified in an SLRA. The following provide examples of (but are not limited to) TS requirements that may relate to AMPs or TLAAs:

- For TS that include administrative controls section provisions that establish preventative maintenance and periodic visual inspection requirements for plant systems located outside of containment [i.e., for applicant’s whose SLRAs include periodic surveillance and preventative maintenance AMPs and whose current licensing basis (CLBs) include these types of TS requirements], the AMPs should establish the relationship of the TS requirements to the applicable program element criteria for their AMPs, as applicable.

- For TS that include administrative controls section provisions that establish fuel oil testing requirements for emergency diesel fuel storage tanks (i.e., for applicant’s whose SLRAs include diesel fuel oil testing AMPs and with CLBs that include these types of TS requirements), the AMPs should establish the relationship of the TS requirements to the applicable program element criteria for their AMPs, as applicable.

- For TS that include pressure-temperature (P-T) limits for their reactor vessels and reactor coolant pressure boundary components in the limiting conditions of operations (LCOs) and control updates of these P-T limits through their 10 CFR 50.90 license amendment request process, the TS requirements may have direct bearing on how the P-T limit TLAAs for the SLRA are accepted in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii).

- For TS that include P-T limits for their reactor vessels and reactor coolant pressure boundary components in a pressure-temperature limit report (PTLR) and controls updates of the P-T limits and PTLR in accordance with a program and process controlled by the administrative controls section of their TS, the TS requirements may have direct bearing on how the P-T limit TLAAs for the SLRA are accepted in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii).

  Acceptance criteria for plant-specific TS are contained in the specific TS provisions or alternatively in referenced documents invoked by the TS requirements. For those SLRAs for plants whose CLBs include TS requirements that relate to an AMP's program element bases for managing specific aging effects, the TS requirements should be reviewed to confirm that they remain adequate for managing the aging effects that are within the scope of the AMPs. Otherwise, the TS requirements should be amended accordingly as part of the SLRA in accordance with 10 CFR 54.22 and the changes in the TS requirement criteria factored into the program element bases for the AMP, as appropriate.

  For those TS requirements that relate to TLAAs, the TS requirements and any methodologies or processes invoked by the TS requirements should be reviewed to see if they need to be amended or new TS requirements need to be proposed in order to demonstrate adequate compliance of the TLAAs in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii). Otherwise, TS changes that are determined as being necessary to disposition TLAAs in accordance with the requirements of 10 CFR 54.21(c)(1)(i), (ii), or (iii) should be included in the SLRA as part of TS change requests under 10 CFR 54.22. This may include TS changes that may be needed for P-T limit TLAAs controlled by PTLR processes, if it is determined that the current P-T limit methodologies approved and invoked by the current administrative controls TS requirements cannot generate P-T limits for the subsequent license renewal (SLR) period that will comply with the P-T limit requirements in 10 CFR Part 50, Appendix G (Ref. 1), and Appendix G of the ASME Code Section XI edition of record for the facility.

5.1.3 Review Procedures

The reviewer should review the applicant's operating license, including the TS that are included as part of the operating license, and procedures to ensure that the applicant has identified all appropriate TS changes or additions that may impact AMPs or TLAAs during the subsequent period of extended operation. If it is determined that new TS requirements, or new operating license conditions are needed to manage specific aging effects, or that changes to the existing TS requirements need to be amended in order to manage such aging effects, the reviewer determines that those license amendments are submitted with the SLRA for U.S. Nuclear Regulatory Commission (NRC) approval in accordance with the requirement in 10 CFR 54.22.

Examples of existing TS requirements that may be used to manage the effects of aging include but are not limited to: (a) preventative maintenance and periodic visual inspection requirements for plant systems located outside of containment, (b) diesel fuel oil monitoring requirements or surveillance requirements that are listed in the administrative controls sections of the TS, which may form the bases for fuel oil chemistry programs used to manage loss of material due to general, pitting, crevice, and microbiologically-induced corrosion in emergency diesel fuel oil system components, and (c) requirements in the TS that govern the applicant's updates to the P-T limits of their plants that constitute part of the mandatory bases for managing and analyzing loss of fracture toughness due to neutron irradiation embrittlement in ferritic steel components of the reactor vessel and reactor coolant pressure boundary. This latter example is a TLAA.

5.1.4 Evaluation Findings

The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of ~~Section 4.5~~this section, and whether the NRC staff's evaluation supports ~~conclusions~~one of the following ~~type, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii),~~three conclusions listed below that is to be included in the NRC staff's safety evaluation report, as applicable for the review of the SLRA:

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided an acceptable ~~demonstration, pursuant to 10 CFR 54.21(c)(1),~~basis for concluding that~~, for~~ the ~~concrete containment tendon prestress~~ SLRA does not need to include any new TS requirements or TS amendments to manage the effects of aging during the SLR period.

> On the basis of its review, as discussed above, the NRC staff concludes that the applicant has provided a list of all new TS provisions or TS changes in the SLRA that are needed to manage the effects of aging during the SLR period, as required by 10 CFR 54.22. The NRC staff also concludes that these TS changes will be capable of managing the effects of aging in accordance the requirement in 10 CFR 54.21(a)(3).

> Pursuant to the requirement in 10 CFR 54.22, as discussed above, the NRC staff concludes that the applicant has provided those new TS provisions or TS changes in the SLRA needed to manage [INSERT APPLICABLE AGING EFFECT], as evaluated in [INSERT NAME of TLAA~~, [choose which is appropriate] (i) the analyses~~] for the SLR period. The NRC staff also concludes that these TS changes adequately demonstrate that the [INSERT NAME of TLAA and then INSERT one of the Following Statements to finish off this conclusion] . . .will remain valid for the ~~period of extended operation, (ii) the analyses have~~ SLR period, as required by 10 CFR 54.21(c)(1)(i)," has been adequately projected to the end of the ~~period of extended operation, or (~~SLR period, as required by 10 CFR 54.21(c)(1)(ii)," effects of [INSERT APPLICABLE AGING EFFECT AND MECHANISM] on the intended functions of the [INSERT APPLICABLE STRUCTURES OR COMPONENTS EVALUATED IN THE TLAA] during the SLR period, as required by 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 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 as reflected in the license condition.~~).

~~4.~~5.1.5 Implementation

~~Except in those cases in which the applicant proposes an acceptable alternative method,~~ The method described herein ~~will be~~is used by the ~~staff in its evaluation of conformance with NRC regulations~~NRC staff to evaluate compliance with NRC regulation in 10 CFR 54.22, which requires the applicant to identify any new TS requirements or TS amendments that are necessary to manage the effects of aging during an SLR period.

~~4.~~5.1.6 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-1801, "Generic Aging Lessons Learned (GALL) Report,"~~ 1. 10 CFR Part 50, "Fracture Toughness Requirements." Appendix G. Washington, DC: U.S. Nuclear Regulatory Commission~~, Revision 2, 2010~~. 2015.

~~**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 forces in the tendons and in 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 minimum required prestressing forces for each group of tendons to the end of this period.~~	~~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 prestressing forces in the tendons and in the surrounding concrete. The aging management program developed to monitor the prestressing forces 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)(viii)(B). If the trend lines cross the PLLs, corrective actions will be taken. The program will also incorporate any plant-specific and industry operating experience.~~	~~Program should be implemented before the period of extended operation.~~

~~* An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.~~

~~2. 4.6 CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATIONS FATIGUE ANALYSIS~~

~~**Review Responsibilities**~~

~~**Primary** - Branch responsible for mechanical engineering~~

~~**Secondary** - Branch responsible for structural engineering~~

~~1.1.8 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 1/4 inch (6.2 millimeter) and 3/8-inch (9.5 millimeter). The liner plates are attached to the concrete containment wall by 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-basis conditions, the liner plates could experience significant strains. Some plants may have metal containments instead of concrete containments with liner plates. The metal containments are designed to carry gravity and seismic loads in addition to the internal pressure and temperature loads. Additionally, the BWR containment suppression pool chamber and the vent system are designed or evaluated for hydrodynamic loads associated with actuation of safety relief valves and the discharge into the suppression pool chamber.~~

~~Fatigue of the liner plates or metal containments may be 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 variation during the heatup and cooldown of the reactor coolant system, a LOCA, 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. The BWR containment suppression pool chamber and the vent system are designed or evaluated for the hydrodynamic cyclic loads as described in Section 6.2.1.1.C, “Pressure-Suppression Type BWR Containments,” of NUREG-0800, “Standard Review Plan” (Ref. 1).~~

~~High energy piping penetrations and the fuel transfer tubes in some plants are equipped with stainless steel 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 or stainless steel plates to provide essentially leak-tight penetrations.~~

~~The containment liner plates, metal containments, BWR containment suppression chamber and the vent system, penetration sleeves (including dissimilar metal welds), and penetration bellows may be designed in accordance with requirements of Section III of the ASME Boiler and Pressure Vessel Code. If a plant’s code of record requires a fatigue analysis, then this analysis may be a 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 are adequately managed for the period of extended operation.~~

~~The adequacy of the fatigue analyses of the containment liner plates (including welded joints), metal containments, BWR containment suppression chamber and the vent system, penetration sleeves, dissimilar metal welds, and penetration bellows is reviewed in this section for the period of extended operation. The fatigue analyses of the pressure boundary of process piping are reviewed separately following the guidance in SRP-LR Section 4.3, "Metal Fatigue."~~

~~*1.1.8.1 4.6.1.1 Time-Limited Aging Analysis*~~

~~The containment liner plates (including welded joints), metal containments, BWR containment suppression chamber and the vent system, penetration sleeves, dissimilar metal welds, and penetration bellows may be designed and/or analyzed in accordance with ASME code requirements. The ASME code contains explicit metal fatigue or cyclic considerations based on TLAAs. Specific requirements are contained in the design code of reference for each plant.~~

~~*1.1.8.1.1 4.6.1.1.1 ASME Section III, MC or Class 1*~~

~~ASME Section III, Division 2, "Code for Concrete Reactor Vessel and Containments," Subsection CC, "Concrete Containment," and Division 1, Subsection NE, "Class MC Components," (Ref. 2) require a fatigue analysis for liner plates, metal containments, and penetrations that considers all cyclic loads based on the anticipated number of cycles. Containment components also may be designed to ASME Section III Class 1 requirements. A Section III, MC or 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 less than or equal to one for acceptable fatigue design. The fatigue resistance of the liner plates or metal containments, and penetrations during the period of extended operation is an area of review.~~

~~*1.1.8.1.2 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) or NE-3366.2(e)(3). For these cases, the discussion relating to ASME Section III, MC or Class 1, in Subsection 4.6.1.1.1 applies.~~

~~1.1.8.2 *4.6.1.2 FSAR Supplement*~~

~~Detailed information on the evaluation of TLAAs is contained in the renewal application. A summary description of the evaluation of TLAAs for the period of extended operation is contained in the applicant's FSAR supplement. The FSAR supplement is an area of review.~~

~~**1.1.9 4.6.2 Acceptance Criteria**~~

~~The acceptance criteria for the areas of review described in Subsection 4.6.1 delineate acceptable methods for meeting the requirements of the NRC's regulations in~~ 2. 10 ~~CFR 54.21(c)(1).~~

~~*1.1.9.1 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, metal containments, liner plate weld joints, dissimilar metal welds, penetration sleeves, and penetration bellows are:~~

~~1.1.9.1.1 4.6.2.1.1 ASME Section III, MC or Class 1~~

~~For containment liner plates, metal containments, BWR containment suppression chamber and the vent system, and penetrations designed or analyzed to ASME MC or Class 1 requirements, the acceptance criteria, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:~~

~~1.1.9.1.1.1 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 will not be exceeded during the period of extended operation.~~

~~1.1.9.1.1.2 4.6.2.1.1.2 10 CFR 54.21(c)(1)(ii)~~

~~CLB fatigue analysis, per ASME Code Section III, was conducted for a 40-year life. The CUF calculations are re-evaluated based on an increased number of assumed cyclic loads to cover the period of extended operation. All cyclic loads considered in the original fatigue analyses (including Type A and Type B leak rate tests) are re-evaluated and revised, as necessary. The revised analysis shows that the CUF does not exceed one, as required by the ASME code, during the period of extended operation.~~

~~1.1.9.1.1.3 4.6.2.1.1.3 10 CFR 54.21(c)(1)(iii)~~

~~An aging management program provided by the applicant shall demonstrate that the effects of aging on the component's intended function(s) will be adequately managed during the period of extended operation. If the proposed aging management program relies on mitigation or inspection, it shall be evaluated against the 10 elements described in Branch~~ 22, "Contents of Application–Technical ~~Position RLSB-1 (Appendix A.1 of this standard review plan). However, if the component is replaced, the CUF for the replacement must be less than or equal to one during the period of extended operation.~~

~~1.1.9.1.2 4.6.2.1.2 Other Evaluations Based on CUF~~

~~The acceptance criteria in Subsection 4.6.2 apply.~~

~~1.1.9.2 4.6.2.2 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 is appropriate 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 the applicant has made the demonstration required by 10 CFR 54.21(c)(1).~~

~~1.1.10 4.6.3 Review Procedures~~

~~For each area of review described in Subsection 4.6.1, the following review procedures is followed:~~

~~1.1.10.1 4.6.3.1 Time-Limited Aging Analysis~~

~~1.1.10.1.1 4.6.3.1.1 ASME Section III, MC or Class 1~~

~~For containment liner plates, metal containments, BWR containment suppression chamber and the vent system, and penetrations designed or analyzed to ASME MC or Class 1 requirements, the review procedures, depending on the applicant's choice of 10 CFR 54.21(c)(1)(i), (ii), or (iii), are:~~

~~1.1.10.1.1.1~~ *~~4.6.3.1.1.1 10 CFR 54.21(c)(1)(i)~~*

~~The number of assumed transients used in the existing CUF calculations for the current operating term is compared to the extrapolation to 60 years of operation of the number of operating transients experienced to date. The comparison confirms that the number of transients in the existing analyses will not be exceeded during the period of extended operation.~~

~~1.1.10.1.1.2 4.6.3.1.1.2 10 CFR 54.21(c)(1)(ii)~~

~~Operating transient experience and a list of the increased number of assumed cyclic loads projected to the end of the period of extended operation are reviewed to ensure that the cyclic load projection is adequate. The revised CUF calculations based on the projected number of assumed cyclic loads are reviewed to ensure that the CUF remains less than one at the end of the period of extended operation.~~

~~The code of record is used for the reevaluation, 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.~~

~~1.1.10.1.1.3 4.6.3.1.1.3 10 CFR 54.21(c)(1)(iii)~~

~~The applicant's proposed aging management program to ensure that the effects of aging on the intended function(s) are adequately managed for the period of extended operation is reviewed. If the program relies on mitigation or inspection, it shall be reviewed against the 10 elements described in Branch Technical Position RLSB-1 (Appendix A.1 of this standard review plan). If the applicant proposes a component replacement before its CUF exceeds one, the reviewer verifies that the CUF for the replacement will remain less than or equal to one during the period of extended operation.~~

~~Applicant-proposed programs are reviewed on a case-by-case basis.~~

~~1.1.10.1.2 4.6.3.1.2 Other Evaluations Based on CUF~~

~~The review procedures in Subsection 4.6.3.1 apply.~~

~~1.1.10.2 4.6.3.2 FSAR Supplement~~

~~The reviewer verifies that the applicant has provided information, to be included in the FSAR supplement that includes a summary description of the evaluation of containment liner plate, metal containments, BWR containment suppression chamber and the vent system, and penetrations fatigue TLAA. Table 4.6-1 contains examples of acceptable FSAR supplement information for this TLAA. The reviewer verifies that the applicant has provided an FSAR supplement with information equivalent to that in Table 4.6-1.~~

~~The staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition will be necessary.~~

~~As noted in Table 4.6-1, the applicant need not incorporate the implementation schedule into its FSAR. However, the review should verify that the applicant has identified and committed in the license renewal application to any future aging management activities, including enhancements and commitments to be completed before the period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.~~

~~1.1.11 4.6.4 Evaluation Findings~~

~~The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of this section and to support 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:~~

> ~~On the basis of its review, as discussed above, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that the containment liner plate or metal containment, BWR containment suppression chamber and the vent system, and penetrations fatigue TLAA, [choose which is appropriate] (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 or metal containment, BWR containment suppression chamber and the vent system, and penetrations fatigue TLAA evaluation for the period of extended operation as reflected in the license condition.~~

~~1.1.12 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 NRC regulations.~~

~~**1.1.13 4.6.6 References**~~

1. ~~NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,"~~Specifications." Washington, DC: U.S. Nuclear Regulatory Commission~~,~~ ~~March 2007.~~

2. ~~ASME Section III, Division 2, "Code for Concrete Reactor Vessels and Containments," Subsection CC, "Concrete Containment," and Division 1, Subsection NE, "MC Components," The ASME Boiler and Pressure Vessel Code, 2004 edition as approved in 10 CFR 50.55a, The American Society of Mechanical Engineers, New York, NY.~~

~~Table 4.6-1 Examples of FSAR Supplement for Containment Liner Plates, Metal Containments, and Penetrations Fatigue TLAA Evaluation~~		
~~10 CFR 54.21(c)(1)(i) Example~~		
~~TLAA~~	~~Description of Evaluation~~	~~Implementation Schedule*~~
~~Containment liner plates (or metal containment) and penetrations fatigue~~	~~The containment liner plates (or metal containment), BWR containment suppression chamber and the vent system, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows that provide an essentially leak-tight barrier. A Section III, MC or Class 1 fatigue analysis limits the CUF to a value less than or equal to one 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 plates (or metal containment) and penetrations fatigue~~	~~The containment liner plates (or metal containment), BWR containment suppression chamber and the vent system, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows that provide an essentially leak-tight barrier. A Section III, MC or Class 1 fatigue analysis limits the CUF to a value less than or equal to one for acceptable fatigue design. The CUF calculations have been reevaluated based on an increased number of assumed cyclic loads to cover the period of extended operation. The revised CUF will not exceed one during the period of extended operation.~~	~~Completed~~
~~10 CFR 54.21(c)(1)(iii) Example~~		
~~TLAA~~	~~Description of Evaluation~~	~~Implementation Schedule*~~
~~Containment liner plates (or metal containment) and penetrations fatigue~~	~~The containment liner plates (or metal containment), BWR containment suppression chamber and the vent system, liner weld joints, penetration sleeves, dissimilar metal welds, and penetration bellows that provide an essentially leak-tight barrier. A Section III, MC or Class 1 fatigue analysis limits the CUF to a value less than or equal to one for acceptable fatigue design. If the component is replaced, the CUF for the replacement will be shown to be less than one during the period of extended operation.~~	~~Program should be implemented before the period of extended operation.~~

~~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).~~

~~* An applicant need not incorporate the implementation schedule into its FSAR. However, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.~~

~~3. 4.7 OTHER PLANT-SPECIFIC TIME-LIMITED AGING ANALYSES~~

~~Review Responsibilities~~

~~**Primary** - NRR branch responsible for the TLAA issues~~

~~**Secondary** - Other branches responsible for systems, as appropriate~~

~~1.1.14 4.7.1 Areas of Review~~

~~There are certain plant-specific safety analyses that may have been based on an explicitly assumed 40-year plant life (for example, aspects of the reactor vessel design) and may, therefore, be TLAAs. Pursuant to 10 CFR 54.21(c), a license renewal applicant is required to evaluate TLAAs. The definition of TLAAs is provided in 10 CFR 54.3 and in Section 4.1 of this SRP-LR.~~

~~Plant-specific TLAAs may have evolved since issuance of a plant's operating license. As indicated in 10 CFR 54.30, the adequacy of the plant's CLB, which includes TLAAs, is not an area within the scope of the license renewal review. Any questions regarding the adequacy of the CLB must 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 required by 10 CFR 54.21(a) or (c) show that there is not 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 functions of those systems, structures, or components are 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 within the scope of the license renewal review.~~

~~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 separately, following the guidance in Section 4.1 of this SRP-LR.~~

~~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 4.6. The reviewer reviews other TLAAs that are identified by the applicant following the generic guidance in this section. For particular systems, the reviewers from branches responsible for those systems may be requested to assist in the review, as appropriate.~~

~~The following areas relating to a TLAA are reviewed:~~

~~1.1.14.1 4.7.1.1 Time-Limited Aging Analysis~~

~~The evaluation of the TLAA for the period of extended operation is reviewed.~~

~~1.1.14.2 4.7.1.2 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.~~

~~1.1.15 4.7.2 Acceptance Criteria~~

~~The acceptance criteria for the areas of review described in Subsection 4.7.1 of this section delineate acceptable methods for meeting the requirements of the NRC's regulations in 10 CFR 54.21(c)(1).~~

~~1.1.15.1 4.7.2.1 Time-Limited Aging Analysis~~

~~Pursuant to 10 CFR 54.21(c)(1)(i) - (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.~~

~~1.1.15.2 4.7.2.2 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 is appropriate such that later changes can be controlled by 10 CFR 50.59. The description contains information associated with the TLAAs regarding the basis for determining that the applicant has made the demonstration required by 10 CFR 54.21(c)(1).~~

~~1.1.16 4.7.3 Review Procedures~~

~~For certain applicants, plant-specific analyses may meet the definition of a TLAA as given in 10 CFR 54.3. The concern for license renewal is that these analyses may not have properly considered the length of the extended period of operation, which may change conclusions with regard to safety and the capability of SSCs within the scope of the Rule to perform or one or more safety functions. The review of these TLAAs provides the assurance that the aging effect is properly addressed through the period of extended operation.~~

~~For each area of review described in Subsection 4.7.1, the following review procedures are followed:~~

~~1.1.16.1 4.7.3.1 Time-Limited Aging Analysis~~

~~For each TLAA identified, the review procedures depend on the applicant's choice of methods of compliance from those identified in 10 CFR 54.21(c)(1)(i), (ii), or (iii), as follows:~~

~~*1.1.16.1.1 4.7.3.1.1 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.~~

~~The applicant describes the TLAA with respect to the objectives of the analysis, assumptions used in the analysis, conditions, acceptance criteria, relevant aging effects, and intended function(s). The applicant shows that (a) conditions and assumptions used in the analysis already address the relevant aging effects for the period of extended operation, and (b) acceptance criteria are maintained to provide reasonable assurance that the intended function(s) is maintained for renewal. Thus, no reanalysis is necessary for renewal.~~

~~In some instances, the applicant may identify activities to be performed to verify the assumption basis of the calculation, such as cycle counting. An evaluation of that activity is provided by the applicant. The reviewer assures that the applicant's activity is sufficient to confirm the calculation assumptions for the 60-year period.~~

~~If the TLAA must be modified or recalculated to extend the period of evaluation to consider the period of extended operation, the reevaluation should be addressed under 10 CFR 54.21(c)(1)(ii).~~

~~*1.1.16.1.2 4.7.3.1.2 10 CFR 54.21(c)(1)(ii)*~~

~~The documented results of the revised analyses are reviewed to verify that their period of evaluation is extended, such that they are valid for the period of extended operation (e.g., 60 years). The applicable analysis technique can be the one that is in effect in the plant's CLB at the time of filing of the renewal application.~~

~~The 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 also may revise the TLAA by recognizing and reevaluating 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. The applicant shall provide a sufficient description of the analysis and documents the results of the reanalysis to show that it is satisfactory for the 60-year period.~~

~~As applicable, the plant's code of record is used for the reevaluation, 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.~~

~~In some cases, the applicant identifies activities to be performed to verify the assumption basis of the calculation, such as cycle counting. An evaluation of that activity is provided by the applicant. The reviewer confirms that the applicant's activity is sufficient to confirm the calculation assumptions for the 60-year period.~~

~~*1.1.16.1.3 4.7.3.1.3 10 CFR 54.21(c)(1)(iii)*~~

~~Under this option, the applicant proposes to manage the aging effects associated with the TLAA by an aging management program in the same manner as described in the 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) are adequately managed consistent with the CLB for the period of extended operation.~~

~~The applicant identifies the structures and components associated with the TLAA. The TLAA is described with respect to the objectives of the analysis, conditions, assumptions used, acceptance criteria, relevant aging effects, and intended function(s). In cases where a mitigation or inspection program is proposed, the reviewer uses 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.~~

~~*1.1.16.2 4.7.3.2 FSAR Supplement*~~

~~The reviewer verifies that the applicant has provided information to be included in the FSAR supplement that includes a summary description of the evaluation of each TLAA. Each such summary description is reviewed to verify that it is appropriate, such that later changes can be controlled by 10 CFR 50.59. The description should contain information that the TLAAs have been dispositioned for the period of extended operation. Sections 4.2 through 4.6 of this standard review plan contain examples of acceptable FSAR supplement information for TLAA evaluation.~~

~~The staff expects to impose a license condition on any renewed license to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior NRC approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59. If the applicant updates the FSAR to include the final FSAR supplement before the license is renewed, no condition is necessary.~~

~~As noted in Sections 4.2 through 4.6, an applicant need not incorporate the implementation schedule into its FSAR. However, the review should verify that the applicant has identified and committed in the license renewal application to any future aging management activities, including enhancements and commitments to be completed before the period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant completes these activities no later than the committed date.~~

~~**1.1.17 4.7.4 Evaluation Findings**~~

~~The reviewer determines whether the applicant has provided sufficient information to satisfy the provisions of Section 4.7 and whether 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:~~

> ~~On the basis of its review, as discussed above, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1), that, for the (name of specific) TLAA, [choose which is appropriate] (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 as reflected in the license condition.~~

~~1.1.18 4.7.5 Implementation~~

~~Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein is used by the staff in its evaluation of conformance with NRC regulations.~~

~~1.1.19 4.7.6 References~~

~~None~~

. 2015.

APPENDIX A

~~BRANCH TECHNICAL~~GENERAL NRC STAFF POSITIONS AND GUIDANCE

APPENDIX A—GENERAL NRC STAFF POSITIONS AND GUIDANCE

A.1 Aging Management Review~~ - GENERIC ~~—Generic (Branch Technical Position RLSB-1)

A.1.1 Background

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(a)(3), a license renewal ~~applicant~~application (LRA) is required to demonstrate that the effects of aging on structures and components (SCs) subject to an aging management review (AMR) are adequately managed so their intended functions will be maintained consistent with the current licensing basis (CLB) for the subsequent period of extended operation. The purpose of this Branch Technical Position (BTP) (RLSB-1) is to address the aging management demonstration that has not been addressed specifically in Chapters 3 and 4 of this Standard Review Plan~~.~~ for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR).

The subsequent license renewal (SLR) process is not intended to demonstrate absolute assurance that ~~structures and components~~SCs will not fail, but rather that there is reasonable assurance that they will perform such that the intended functions are maintained consistent with the ~~current licensing basis (~~CLB~~)~~ during the subsequent period of extended operation.

There are generally four types of aging management programs (AMPs): (i) prevention, (ii) mitigation, (iii) condition monitoring, and (iv) performance monitoring.

Prevention Programs preclude the effects of aging. For example, coating programs prevent external corrosion of a tank.

Mitigation Programs attempt to slow the effects of aging. For example, water chemistry programs mitigate internal corrosion of piping.

Condition Monitoring Programs inspect for the presence and extent of aging effects~~.~~ or perform tests that monitor potential changes in a components or structure's material condition. Examples of programs that involve inspections are the visual examination of concrete structures for cracking and the ultrasonic examination of pipe wall for flow-accelerated corrosion (FAC~~)-induced wall thinning.~~)-induced wall thinning. Examples of programs that involve material testing are reactor pressure vessel material surveillance capsule testing programs that monitor for embrittlement in ferritic reactor pressure vessel component's and material testing programs that monitor for degradation in spent fuel pool neutron absorption materials.

Performance Monitoring Programs test the ability of a structure or component to perform its intended function(s). For example, the ability of the tubes on heat exchangers to transfer heat is tested.

More than one type of AMP may be 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. In addition, some AMPs may incorporate more than one of the activities of prevention, mitigation, condition monitoring, or performance monitoring. For example, open cycle cooling water programs may incorporate combinations of inspection (condition monitoring) and flow testing (performance monitoring) activities.

A.1.2 Branch Technical Position

A.1.2.1 Applicable Aging Effects

1. The determination of applicable aging effects is based on degradation mechanisms that have occurred and those that potentially could cause ~~structure and component~~SC 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 intended function(s) of ~~structures and components~~SCs also should be considered.

2. Relevant aging information may be contained in, but is not limited to, the following documents: (i) plant-specific maintenance and inspection records; (ii) plant-specific site deviation or issue reports; (iii) plant-specific U.S. Nuclear Regulatory Commission (NRC) and Institute of Nuclear Power Operations (INPO) inspection reports; (iv) plant-specific licensee self-assessment reports; (v) plant-specific and other licensee event ~~reports~~report (LERs); (vi) NRC, INPO, and vendor generic communications; and (vii) generic safety issues (GSIs~~/~~)/unresolved safety issues (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 applicable and an applicant determines that it is not applicable to its specific plant, the reviewer may question the absence of this aging effect ~~unless~~if the applicant has not provided ~~the~~a sufficient basis ~~for this determination~~ in its subsequent license renewal application~~. However, in questioning the absence of the aging effect, a reference and/or basis which aided the applicant in addressing the question should be provided.~~ (SLRA). For example, the question could cite a previous application review, NRC generic communications, engineering judgment, relevant research information, or other industry experience as the basis for the question. Simply citing that the aging effect is listed in the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report is not a sufficient basis. For example, it may be that the aging effect is applicable to a pressurized water reactor (PWR) component, but the applicant's plant is a boiling water reactor (BWR) and does not have such a component. In this example, using the GALL-SLR Report merely as a checklist is not ~~relevant~~appropriate.

4. An aging effect may not have been identified in the GALL-SLR Report, if it arises out of industry experience after the issuance of the GALL-SLR Report. The reviewer should ensure that the applicant has evaluated the latest industry experience to identify all applicable aging effects.

5. An aging effect should be identified as applicable for ~~license renewal~~SLR even if there is a prevention 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~~SLR, and the AMR should consider the adequacy of the AMP referencing water chemistry, coating, or cathodic protection.

6. 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).

7. The applicable aging effects to be considered for ~~license renewal~~SLR include those that could result from normal plant operation, including plant~~/~~ or system operating transients and plant shutdown. Specific aging effects from abnormal events need not be postulated for ~~license renewal.~~SLR. However, if an abnormal event has occurred at a particular plant, its contribution to the aging effects on ~~structures and components~~SCs for ~~license renewal~~SLR 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; they include design basis pipe break, loss of coolant accident (LOCA), and safe shutdown earthquake (SSE). Potential aging effects 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; aging effects from such abuse need not be postulated for ~~license renewal.~~SLR. 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 (see 10 CFR Part 50 Appendix B) to ensure functionality of the equipment. The equipment degradation is not due to aging; corrective action is not necessary solely for the subsequent period of extended operation. However, 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 bolted connections should be evaluated for license renewal.~~ In addition, condensation frequently occurs during humid periods of normal plant operation and can also occur during plant shutdown when normally hot components might be below the dew point. The aging effects from leakage of bolted connections and condensation occurring during humid periods of normal plant operations should be evaluated for SLR. Condensation during plant shutdowns could result in aging effects such as reduced thermal insulation resistance due to moisture intrusion and should be evaluated for SLR. It is less likely that condensation during plant shutdowns would result in loss of material, unless plant-specific operating experience dictates otherwise (e.g., as a result of extended plant shutdowns).

An aging effect due to an abnormal event does not preclude that aging effect from occurring during normal operation for the subsequent period of extended operation. For example, a certain PWR licensee 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 be evaluated for ~~license renewal.~~SLR. 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 Program for Subsequent License Renewal

1. An acceptable AMP 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 ~~AMPs/~~programs and

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 AMP. Probabilistic arguments may be used to develop 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~~SCs subject to an AMR, the effects of aging will be adequately managed in the subsequent period of extended operation. Thus, risk significance may be considered in developing the details of an AMP for the structure or component for ~~license renewal~~SLR, but may not be used to conclude that no AMP is necessary for ~~license renewal~~SLR.

4. For programs that rely on NRC-endorsed technical or topical reports (TRs), the scope of the AMP includes the applicant's bases for resolving or addressing any NRC limitations or applicant/licensee action items that are placed on the activities for implementing a given report's methodology. These limitations or action items are identified in the NRC's safety evaluation on the TR's methodology and recommended activities. If it is determined that the response to a specific applicant action item will result in the need for augmentation of specific programmatic criteria beyond those activities recommended in the applicable TR, the applicant should define the AMP accordingly to identify the AMP program element or elements that are impacted by the basis for responding to the applicable action item and the adjustments that will need to be made to the TR guidance recommendations, as defined in the impacted program elements for the AMP and applicable to the CLB and design basis for the facility. It is also recommended that the applicants provide their bases for resolving the specific limitations or action items in Appendix C of their SLRAs.

A.1.2.3 Aging Management Program Elements

A.1.2.3.1 Scope of Program

The specific program necessary for ~~license renewal~~SLR should be identified. The scope of the program should include the specific ~~structures and components~~SCs, the aging of which the program manages.

A.1.2.3.2 Preventive Actions

1. The activities for prevention and mitigation programs should be described. These actions should mitigate or prevent aging degradation.

2. Some condition or performance monitoring programs do not rely on preventive actions and thus, this information need not be provided.

3. In some cases, condition or performance monitoring programs may also rely on preventive actions. The specific prevention activities should be specified.

A.1.2.3.3 Parameters Monitored or Inspected

1. This program element should identify the aging effects that the program manages and should provide a link between the parameter or parameters that will be monitored and how the monitoring of these parameters will ensure adequate aging management.

2. For a condition monitoring program, the parameter monitored or inspected should be capable of detecting the presence and extent of aging effects. Some examples are measurements of wall thickness and detection and sizing of cracks.

3. For a performance monitoring program, a link should be established between the degradation of the particular structure or component-intended function(s) and the parameter(s) being monitored. An example of linking the degradation of a passive component-intended function with the performance being monitored is linking the fouling of heat exchanger tubes with the heat transfer-intended function~~.~~ as identified by a change in the differential temperature across the heat exchanger tubes. This could be monitored by periodic heat balances. Since this example deals only with one intended function of the tubes (heat transfer), additional programs may be necessary to manage other intended function(s) of the tubes, such as pressure boundary. Thus, a performance monitoring program must ensure that the ~~structure and components~~SCs are capable of performing their intended functions by using a combination of performance monitoring and evaluation (if outside acceptable limits of acceptance criteria) that demonstrate that a change in performance characteristic is a result of an age-related degradation mechanism.

4. For prevention or 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 that 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~~SC-intended function(s). The parameters to be monitored or inspected should be appropriate to ensure that the ~~structure- and component~~SC-intended function(s) will be adequately maintained for ~~license renewal~~SLR under all CLB design conditions. Thus, the discussion for the “detection of aging effects” program element should address (a) how the program element would be capable of detecting or identifying the occurrence of age-related degradation or an aging effect prior to a loss of ~~structure and component (SC)~~ SC-intended function or (b) for preventive/mitigative programs, how the program would be capable of preventing or mitigating their occurrence prior to a loss of a SC-intended function. The discussion should provide information that links the parameters to be monitored or inspected to the aging effects being managed.

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.~~SLR. A program based solely on detecting structure and component failure should not be considered as an effective AMP for ~~license renewal~~SLR.

3. This program element describes “when,” “where,” and “how” program data are collected (i.e., all aspects of activities to collect data as part of the program).

4. For condition monitoring programs, the method or technique (such as visual, volumetric, or surface inspection), frequency, and timing of new, one-time inspections may be linked to plant-specific or ~~industrywide~~industry-wide operating experience. The discussion ~~should provide~~provides justification, including codes and standards referenced, that the technique and frequency are adequate to detect the aging effects before a loss of SC-intended function. A program based solely on detecting SC failures is not considered an effective AMP.

   For a condition monitoring program, when sampling is used to represent a larger population of SCs, applicants ~~should~~ provide the basis for the inspection population and sample size. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects. The sample size should be based on such aspects of the SCs as the specific aging effect, location, existing technical information, system and structure design, materials of construction, service environment, or previous failure history. The samples ~~should be~~are biased toward locations most susceptible to the specific aging effect of concern in the subsequent period of extended operation. Provisions on expanding the sample size when degradation is detected in the initial sample should also be included. For multiunit sites, samples are conducted at all units. Provisions for expanding the sample size when degradation is detected in the initial sample are included.

5. For a performance monitoring program, the “detection of aging effects” program element should discuss and establish the monitoring methods that will be used for performance monitoring. In addition, the “detection of aging effects” program element should also establish and justify the frequency that will be used to implement these performance monitoring activities.

6. For a prevention or mitigation program, the “detection of aging effects” program element should discuss and establish the monitoring methods that the program will use to monitor for the preventive or mitigative parameters that the program controls and should justify the frequency of performing these monitoring activities.

A.1.2.3.5 Monitoring and Trending

1. Monitoring and trending activities should be described, and they should provide a prediction of the extent of degradation and thus effect timely corrective or mitigative actions. Plant-specific and/or industrywide operating experience may be considered in evaluating the appropriateness of the technique and frequency.

2. This program element describes “how” the data collected are evaluated and may also include trending for a forward look. This includes an evaluation of the results against the acceptance criteria and a prediction regarding the rate of degradation in order to confirm that timing of the next scheduled inspection will occur before a loss of SC-intended function. Although aging indicators may be quantitative or qualitative, aging indicators should be quantified, to the extent possible, to allow trending. The parameter or indicator trended should be described. The methodology for analyzing the inspection or test results against the acceptance criteria should be described. Trending is a comparison of the current monitoring results with previous monitoring results in order to make predictions for the future.

A.1.2.3.6 Acceptance Criteria

1. The quantitative or qualitative acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions are evaluated, should ensure that the ~~structure- and component~~SC-intended function(s) are maintained consistent with all CLB design conditions during the subsequent 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 FAC. An AMP for FAC 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, before 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 specific numerical values, or could consist of a discussion of the process for calculating specific numerical values of conditional acceptance criteria to ensure that the ~~structure- and component~~SC-intended function(s) will be maintained under all CLB design conditions. Information from available references may be cited.

3. It is not necessary to justify any acceptance criteria taken directly from the design basis information that is included in ~~either~~ the Final Safety Analysis Report (FSAR), plant Technical Specifications~~,~~ (TS), or other codes and standards incorporated by reference into NRC regulations; they are a part of the CLB. Nor is it necessary to justify the acceptance criteria that have been established in either NRC-accepted or NRC-endorsed methodology, such as those that may be given in NRC-approved or NRC-endorsed topical reports or NRC-endorsed codes and standards; the acceptance criteria referenced in these types of documents have been subject to an NRC review process and have been approved or endorsed for their application to an NRC-approved or NRC~~-~~-endorsed evaluation methodology. Also, it is not necessary to discuss CLB design loads if the acceptance criteria do not permit degradation because a ~~structure and component~~SC without degradation should continue to function as originally designed. Acceptance criteria, which do permit degradation, are based on maintaining the intended function under all CLB design loads.

A.1.2.3.7 Corrective Actions

1. Actions to be taken when the acceptance criteria are not met should be described in appropriate detail or referenced to source documents. 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~~SC-intended function(s) are maintained consistent with the CLB.

3. ~~For safety-related components, an applicant's 10 CFR Part 50, Appendix B, Quality Assurance Program, is an acceptable means to confirm~~Results that do not meet the ~~corrective actions~~acceptance criteria are ~~done in a manner consistent with the condition monitoring program, preventive program, mitigative program,~~addressed as conditions

adverse to quality or ~~performance monitoring program that is credited for aging management. For example, for a plant-~~significant conditions adverse to quality under those specific ~~condition monitoring program that is based on ASME Section XI requirements, the implementation~~portions of the quality assurance (QA) program that are used to meet Criterion XVI, “Corrective Action,” of 10 CFR Part 50, Appendix B. Appendix A.2 describes how an applicant may apply its 10 CFR Part 50, Appendix B ~~program should ensure that any~~, QA program to fulfill the corrective actions element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

~~3.~~4. For plant-specific programs that rely on NRC-endorsed Technical or TRs, the corrective actions are ~~performed~~implemented in accordance with corrective actions recommended in the applicable ~~Code requirements or NRC-approved Code cases~~TR or TRs, or the applicant’s 10 CFR Part 50, Appendix B, QA process, as applicable.

A.1.2.3.8 Confirmation Process

1. The confirmation process should be described. The process ensures that ~~preventive actions are adequate and that~~ appropriate corrective actions have been completed and are effective.

~~2. The effectiveness of prevention and mitigation programs should be verified periodically. For example, in managing internal corrosion of piping, a mitigation program (water chemistry) may be used to minimize susceptibility to corrosion. However, it also may be necessary to have a condition monitoring program (ultrasonic inspection) to verify that corrosion is indeed insignificant.~~

2. The confirmation process is addressed through those specific portions of the QA program that are used to meet Criterion XVI, “Corrective Action,” of 10 CFR Part 50, Appendix B. Appendix A.2 describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the confirmation process element of this AMP for both safety-related and nonsafety-related systems, structures, and components (SSCs) within the scope of this program.

3. When ~~corrective actions~~significant conditions adverse to quality are ~~necessary~~identified, there should be follow-up activities to confirm that the corrective actions have been completed, a root cause determination was performed, and recurrence will be prevented.

4. For plant-specific condition monitoring programs that rely on the augmented inspection and evaluation methodologies in NRC-endorsed Technical or TRs, the administrative controls for these types of programs, including their implementing procedures and review and approval processes, are implemented in accordance existing site 10 CFR 50 Appendix B, QA Programs, or their equivalent, as applicable. Additional administrative controls criteria may apply as identified in the TRs or in other industry reports or guidelines, such as those developed by (but not limited to) Nuclear Energy Institute (NEI), the EPRI Boiling Water Reactor Vessel and Internals Project (BWRVIP), EPRI Materials Reliability Program (MRP), BWR Owners Group, PWR Owners Group, or industry vendors, such as AREVA, Westinghouse, or General Electric (GE) or GE-Hitachi.

A.1.2.3.9 Administrative Controls

1. The administrative controls of the program should be described. Administrative controls provide a formal review and approval process.

~~2. Any AMPs 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 include 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 must be administratively controlled and included in the FSAR supplement.~~

2. Administrative controls are addressed through the QA program that is used to meet the requirements of 10 CFR Part 50, Appendix B, associated with managing the effects of aging (e.g., document control, special processes, and test control). Appendix A.2 describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the administrative controls element of this AMP for both safety-related and nonsafety-related SCs within the scope of this program.

3. For plant-specific condition monitoring programs that rely on the augmented inspection and evaluation methodologies in NRC-endorsed Technical or TRs, the administrative controls for these types of programs, including their implementing procedures and review and approval processes, are implemented in accordance existing site 10 CFR 50 Appendix B, QA Programs, or their equivalent, as applicable. Additional administrative controls criteria may apply as identified in the TRs or in other industry reports or guidelines, such as those developed by (but not limited to) NEI, the EPRI BWRVIP, EPRI MRP, BWR Owners Group, PWR Owners Group, or industry vendors, such as AREVA, Westinghouse, or GE or GE-Hitachi.

A.1.2.3.10 Operating Experience

1. ~~1.~~ Consideration of future plant-specific and industry operating experience relating to ~~aging management programs~~ AMPs should be discussed~~.~~ (See Appendix A.4). Reviews of operating experience by the applicant in the future may identify areas where ~~aging management programs~~AMPs should be enhanced or new programs developed. An applicant should commit to a future review of plant-specific and industry operating experience to confirm the effectiveness of its ~~aging management programs~~AMPs or indicate a need to develop new ~~aging management programs.~~AMPs. This information should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the ~~structure and component~~SC intended function(s) will be maintained during the subsequent period of extended operation.

2. ~~2.~~ Currently available operating experience with existing programs should be discussed. The discussion should note any changes to the programs during the first period of extended operation. The operating experience of ~~AMPs that are~~ existing programs, including past corrective actions resulting in program enhancements or additional programs, should be considered. A past failure would not necessarily invalidate an AMP 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 at all)~~not been fully effective in intercepting aging degradation in a timely manner. This information should provide objective evidence to support the conclusion that the effects

of aging will be managed adequately so that the ~~structure- and component~~SC-intended function(s) will be maintained during the subsequent period of extended operation.

3. ~~3.~~ Currently available operating experience applicable to new programs should also be discussed. For new AMPs that have yet to be implemented at an applicant's facility, the programs have not yet generated any operating experience ~~(OE).~~. However, there may be other relevant plant-specific ~~OE at the plant~~ or generic ~~OE in the~~ industry operating experience that is relevant to the ~~AMP's~~ program elements, even though the ~~OE~~operating experience was not identified ~~as a result of the~~through implementation of the new program. Thus, when developing the elements for new programs, an applicant ~~may need to~~should consider the impact of relevant ~~OE that results~~operating experience from ~~the past~~ implementation of its existing AMPs ~~that are existing programs and~~ and from generic industry operating experience.

~~3.~~4. For plant-specific condition monitoring programs that rely on the augmented inspection and evaluation methodologies in NRC-endorsed Technical or TRs, the administrative controls for these types of programs, including their implementing procedures and review and approval processes, are implemented in accordance with existing site 10 CFR 50 Appendix B, QA Programs, or their equivalent, as applicable. Additional administrative controls criteria may apply as identified in the TRs or in other industry reports or guidelines, such as those developed by (but not limited to) NEI, the ~~impact of relevant generic OE on developing the program elements. Therefore, operating experience applicable to new programs should be discussed. Additionally, an applicant should commit to a review of future plant-specific and industry operating experience for new programs to confirm their effectiveness~~EPRI BWRVIP, EPRI MRP, BWR Owners Group, PWR Owners Group, or industry vendors, such as AREVA, Westinghouse, or GE or GE-Hitachi.

A.1.3 References

NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54~~—~~– The License Renewal Rule," Nuclear Energy Institute, Revision 6

~~1.~~

Table A.1-1.	**Elements of an Aging Management Program for Subsequent License Renewal**
Element	**Description**
1. Scope of Program	Scope of program includes the specific ~~structures and components~~SCs subject to an AMR for ~~license renewal~~SLR.
2. Preventive Actions	Preventive actions should prevent or mitigate aging degradation.
3. Parameters Monitored or Inspected	Parameters monitored or inspected should be linked to the degradation of the particular ~~structure or component~~SC-intended function(s).
4. Detection of Aging Effects	Detection of aging effects should occur before there is a loss of ~~structure or component~~SC-intended function(s). This includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new/one-time inspections to ensure timely detection of aging effects.
5. Monitoring and Trending	Monitoring and trending should provide predictability of the extent of degradation, and timely corrective or mitigative actions.
6. Acceptance Criteria	Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the ~~structure or component~~ SC-intended function(s) are maintained under all CLB design conditions during the subsequent 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	~~If the AMP is an existing program,~~ Operating experience ~~of~~applicable to the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the ~~structure- and component~~SC-intended function(s) will be maintained during the subsequent period of extended operation. Operating experience with existing programs should be discussed In addition, the ongoing review of both plant-specific and industry operating experience ensures that the AMP is effective in managing the aging effects for which it is credited. The AMP is either enhanced or new AMPs are developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed.

A.2 Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)

A.2.1 Background

The subsequent license renewal ~~applicant~~application (SLRA) is required to demonstrate that the effects of aging on structures and components (SCs) subject to an aging management review (AMR) will be managed adequately to ensure that their intended functions are maintained consistent with the current licensing basis (CLB) of the facility for the subsequent period of extended operation. Therefore, those aspects of the AMR process that affect quality of safety~~-~~-related systems, structures, ~~systems,~~ and components (SSCs) are subject to the quality assurance (QA) requirements of ~~10 CFR~~Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 Appendix B. For nonsafety-related ~~structures and components (SCs)~~SCs subject to an AMR, the existing 10 CFR Part 50 Appendix B QA program may be used by the applicant to address the elements of corrective actions, the confirmation process, and administrative controls, as described in Branch Technical Position RLSB-1 (Appendix A.1 of this ~~standard review plan for license renewal~~ [SRP-~~LR]).~~SLR). The confirmation process ensures that ~~preventive actions are adequate and that~~ appropriate corrective actions have been completed and are effective. Administrative controls should provide for a formal review and approval process. ~~Reference 1~~ Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report describes how a subsequent license renewal (SLR) 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 (IQMB-1) is to describe an acceptable process for implementing the corrective actions, the confirmation process, and administrative controls of aging management programs (AMPs) for ~~license renewal~~SLR.

A.2.2 Branch Technical Position

1. Safety-related SCs are subject to 10 CFR Part 50 Appendix B requirements, which are adequate to address all quality-related aspects of an ~~aging management program~~AMP consistent with the CLB of the facility for ~~the~~subsequent period of extended operation.

2. For nonsafety-related SCs that are subject to an AMR for ~~license renewal~~SLR, an applicant has the option to expand the scope of its 10 CFR Part 50 Appendix B program to include these SCs and to address corrective actions, the confirmation process, and administrative controls for aging management during the subsequent period of extended operation. The reviewer verifies that the applicant has documented such a commitment in the Final Safety Analysis Report (FSAR) supplement in accordance with 10 CFR 54.21(d).

3. If an applicant chooses an alternative means to address corrective actions, the confirmation process, and administrative controls for managing aging of nonsafety-related SCs that are subject to an AMR for ~~license renewal~~SLR, the applicant’s proposal is reviewed on a case-by-case basis following the guidance in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-~~LR~~SLR).

A.2.3 References

~~1. NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” U.S. Nuclear Regulatory Commission, Revision 2, 2010.~~

None.

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~~U.S. Nuclear Regulatory Commission (NRC) formal resolution process set forth in NUREG~~-~~–0933, "Resolution of Generic Safety Issues," which is updated periodically (Ref. 1). Appendix B to NUREG~~-~~–0933 contains a listing of those issues that are applicable to operating and future plant. NUREG~~-~~–0933 is a source of information on generic concerns identified by the NRC. Some of these concerns may be related to the effects of aging or time-limited aging analyses (TLAAs) for systems, structures, or components within the scope of the subsequent license renewal (SLR) review. The purpose of this Branch Technical Position (RLSB-2) is to address the ~~license renewal~~SLR treatment of an aging effect or a TLAA which is a subject of an USI or a GSI ~~(~~[60 Federal Register (FR) 22484~~).~~].

~~Table A.3-1 provides examples to help determine whether a USI or GSI should or should not be specifically addressed for license renewal, based on lessons learned from the staff review of the initial license renewal applications. However, two of these examples (GSI-23 and -190) have been resolved by the staff. They are included in the examples for illustrative purposes.~~

A.3.2 Branch Technical Position

A.3.2.1 Treatment of GSIs

The license renewal rule requires that aging effects be managed to ensure that the ~~structure-~~ structures and ~~component-~~components (SC) intended function(s) are maintained and that TLAAs are evaluated for ~~license renewal.~~SLR. Thus, all applicable aging effects of ~~structures and components~~SCs subject to an aging management review (AMR) and all TLAAs must be evaluated, regardless of whether they are associated with GSIs or USIs. The agency's Generic Issues Program process for resolving GSIs is described in Management Directive 6.4, "Generic Issues Program," dated November 17, 2009, and SECY-07-0022, "Status Report on Proposed Improvements to the Generic Issues Program."

~~1. USIs and HIGH- and MEDIUM-priority issues described in NUREG-0933 Appendix B (Ref. 1) that involve aging effects for structures and components subject to an AMR or TLAAs are specifically addressed. The version of NUREG-0933 that is current on the date 6 months before the date of the license renewal application is used to identify such issues. Prior to Safety Evaluation Report (SER) completion, any new issues contained in later versions of NUREG-0933 should be reviewed and resolved if applicable to the applicant's plant. New issues are addressed by using one of the approaches described in Position A.3.2.2 below.~~

~~2. New generic safety issues, designated as USI, HIGH-, or MEDIUM- priority after the application has been submitted, that involve aging effects for structures and components subject to an aging management review or TLAA should be submitted in the annual update of the application.~~

~~3. 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 is generically applicable to other nuclear plants. If issues have generic applicability (but are not yet~~

~~part of the formal GSIs 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 managed adequately or that TLAAs are evaluated for the period of extended operation.~~

~~*1.1.19.1 A.3.2.2 Approaches for Addressing GSIs (60 FR 22484)*~~

~~One of the following approaches may be used:~~

1. ~~If resolution has been achieved before issuance of a renewed license, implementation of that resolution is incorporated within the license renewal application. The plant-specific implementation information is provided.~~

2. ~~A technical rationale is provided that demonstrates that the CLB will be maintained until some later 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) become available to adequately manage the effects of aging. An applicant describes the basis for concluding that the CLB is maintained during the period of extended operation and briefly describes options that are technically feasible during the period of extended operation to manage the effects of aging, but does not have to preselect which option to use.~~

3. ~~An aging management program is developed that, 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) is proposed that, if approved, removes 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.~~

A.4 Operating Experience for Aging Management Programs

A.4.1 Background

Operating experience is a crucial element of an effective aging management program (AMP). It provides the basis to support all other elements of the AMP and, as a continuous feedback mechanism, drives changes to these elements to ensure the overall effectiveness of the AMP. Operating experience should provide objective evidence to support the conclusion that the effects of aging are managed adequately so that the structures and components (SC)-intended function(s) will be maintained during the subsequent period of extended operation. Under their current operating licenses, subsequent license renewal (SLR) applicants are required to implement programs for the ongoing review of operating experience, such as those established in accordance with Item I.C.5, "Procedures for Feedback of Operating Experience to Plant Staff," of NUREG–0737, "Clarification of TMI Action Plan Requirements" (Ref. 3).

A.4.2 Position

The systematic review of plant-specific and industry operating experience concerning aging management and age-related degradation ensures that the SLR AMPs are, and will continue to be, effective in managing the aging effects for which they are credited. The AMPs should either be enhanced or new AMPs developed, as appropriate, when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. AMPs should be informed by the review of operating experience on an ongoing basis, regardless of the AMP's implementation schedule.

Acceptable Use of Existing Programs

Programs and procedures relied upon to meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B (Ref. 1) and NUREG–0737 (Ref. 3), Item I.C.5, may be used for the capture, processing, and evaluation of operating experience concerning age-related degradation and aging management during the term of a renewed operating license. As part of meeting the requirements of NUREG–0737, Item I.C.5, the applicant should actively participate in the Institute of Nuclear Power Operations' operating experience program [formerly the Significant Event Evaluation and Information Network (SEEIN) program endorsed in U.S. Nuclear Regulatory Commission (NRC) Generic Letter (GL) 82-04, "Use of INPO SEEIN Program"] (Ref. 2). These programs and procedures may also be used for the translation of recommendations from the operating experience evaluations into plant actions (e.g., enhancement of AMPs and development of new AMPs). While these programs and procedures establish a majority of the functions necessary for the ongoing review of operating experience, they are also subject to further review as discussed below.

Areas of Further Review

To ensure that the programmatic activities for the ongoing review of operating experience are adequate for SLR, the following points should be addressed:

- The programs and procedures relied upon to meet the requirements of 10 CFR Part 50, Appendix B, and NUREG–0737, Item I.C.5, explicitly apply to and otherwise would not preclude the consideration of operating experience on age-related degradation and aging management. Such operating experience can constitute information on the SCs identified in the integrated plant assessment; their materials, environments, aging effects, and aging mechanisms; the AMPs credited for managing the effects of aging; and the activities, criteria, and evaluations integral to the elements of the AMPs. To satisfy this criterion, the applicant should use the option described in A.2.2.2 of Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Appendix A.2, “Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1),” to expand the scope of its 10 CFR Part 50, Appendix B, program to include nonsafety-related SCs.

- The license renewal interim staff guidance (LR-ISG) documents and revisions to the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report should be considered as sources of industry operating experience and evaluated accordingly. There should be a process to identify such documents and process them as operating experience.

- All incoming plant-specific and industry operating experience should be screened to determine whether it may involve age-related degradation or impacts to aging management activities.

- A means should be established within the corrective action program to identify, track, and trend operating experience that specifically involves age-related degradation. There should also be a process to identify adverse trends and to enter them into the corrective action program for evaluation.

- Operating experience items identified as potentially involving aging should receive further evaluation. This evaluation should specifically take into account the following: (a) systems, structures, and components (SSCs), (b) materials, (c) environments, (d) aging effects, (e) aging mechanisms, (f) AMPs, and (g) the activities, criteria, and evaluations integral to the elements of the AMPs. The assessment of this information should be recorded with the operating experience evaluation. If it is found through evaluation that any effects of aging may not be adequately managed, then a corrective action should be entered into the 10 CFR Part 50, Appendix B, program to either enhance the AMPs or develop and implement new AMPs.

- Assessments should be conducted on the effectiveness of the AMPs and activities. These assessments should be conducted on a periodic basis that is not to exceed once every five years. They should be conducted regardless of whether the acceptance criteria of the particular AMPs have been met. The assessments should also include evaluation of the AMP or activity against the latest NRC and industry guidance documents and standards that are relevant to the particular program or activity. If there is an indication that the effects of aging are not being adequately managed, then a corrective action is entered into the 10 CFR Part 50, Appendix B, program to either enhance the AMPs or develop and implement new AMPs, as appropriate.

- Training on age-related degradation and aging management should be provided to those personnel responsible for implementing the AMPs and those personnel who may submit, screen, assign, evaluate, or otherwise process plant-specific and industry operating experience. The scope of training should be linked to the responsibilities for processing operating experience. This training should occur on a periodic basis and include provisions to accommodate the turnover of plant personnel.

- Guidelines should be established for reporting plant-specific operating experience on age-related degradation and aging management to the industry. This reporting should be accomplished through participation in the Institute of Nuclear Power Operations' operating experience program.

- Any enhancements necessary to fulfill the above criteria should be put in place no later than the date the renewed operating license is issued and implemented on an ongoing basis throughout the term of the renewed license.

The programmatic activities for the ongoing review of plant-specific and industry experience concerning age-related degradation and aging management should be described in the subsequent license renewal application (SLRA), including the Final Safety Analysis Report (FSAR) supplement. Alternate approaches for the future consideration of operating experience are subject to NRC review on a case-by-case basis.

A.4.3 ~~.3~~ References

~~1. NUREG-0933, "Resolution of Generic Safety Issues," Supplement 32, U.S. Nuclear Regulatory Commission, August 2008.~~

~~2. NRC Regulatory Issue Summary 2000-02, "Closure of Generic Safety Issue 23, Reactor Coolant Pump Seal Failure," February 15, 2000.~~

~~Letter from Ashok C. Thadani of the~~1. 10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants*, Office of the Federal Register, National Archives and Records Administration, 2015.

2. Generic Letter 82-04, "Use of INPO SEE-IN Program." March 9, 1982. U.S. Nuclear Regulatory Commission.

3. NUREG–0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory ~~Research, NRC, to William D. Travers, Executive Director of Operations, NRC, dated December 26, 1999~~Commission.

~~3. SECY 94-225, "Issuance of Proposed Rulemaking Package on GSI-23, Reactor Coolant Pump Seal Failure," August 26, 1994.~~

~~4. Information Notice 93-61, "Excessive Reactor Coolant Leakage Following a Seal Failure in a Reactor Coolant Pump or Reactor Recirculation Pump," August 9, 1993.~~

~~5. Deleted.~~

~~6. NRC Regulatory Issue Summary 2003-09, "Environmental Qualification of Low-Voltage Instrumentation and Control Cables" dated May 2, 2003.~~

~~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 PWRs. Although GSI-23 originally addressed seal performance both during normal operation and during loss of seal cooling conditions, it has been modified to address only 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 AMR or TLAA, GSI-23 need 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 requirements. Environmental qualification is a TLAA for license renewal.~~ ~~Regulatory Issue Summary (RIS) 2003-09 was issued on May 2, 2003, to inform addressees of the results of the technical assessment of GSI-168, "Environmental Qualification of Electrical Equipment." This RIS requires no action on the part of the addressees (Ref. 7).~~
~~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 RG 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 need 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).~~

4. NUREG–1801, “Generic Aging Lessons Learned (GALL) Report,” U.S. Nuclear Regulatory Commission.